VOL. XVIII. No. 4 APRIL 1933

MECCANO MAGAZINE

6D.

COALING THE "FLYING SCOTSMAN" IN THREE MINUTES

(see page 264)



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PATENTED OR PATENTS PENDING
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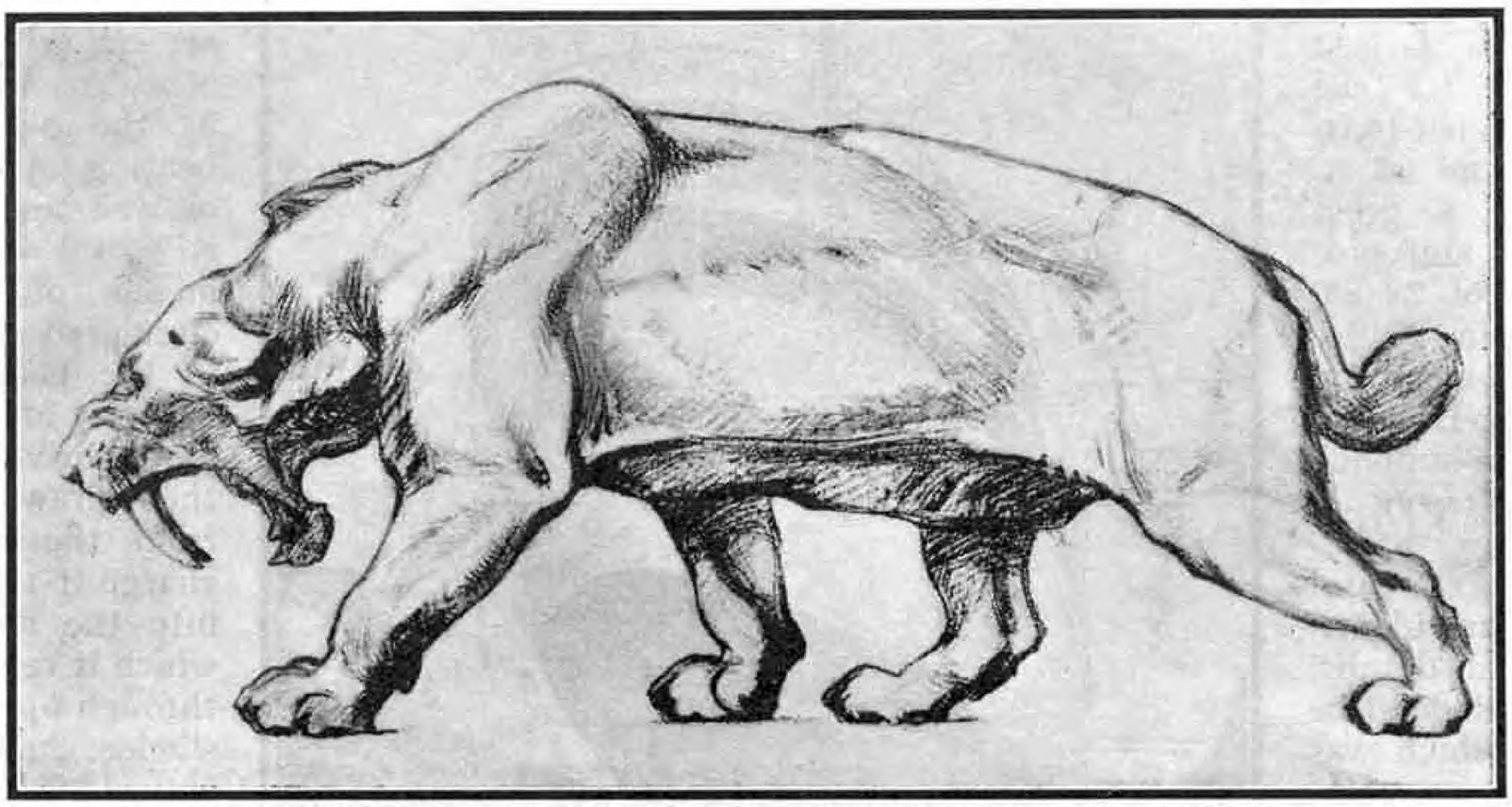
Vol. XVIII. No. 4
April, 1933

With the Editor

Unique Relics of Extinct Creatures

Fossil hunting, or probing beneath the surface of the Earth with the object of finding traces of the animal life of millions of years ago, is a fascinating pursuit, but one that requires great patience. Those who follow it must be prepared for frequent disappointments after weeks or even months of hard work. Occasionally they are rewarded by discoveries of great stores of prehistoric remains, however, and then their fortune is great.

Many animals that are now extinct made their dens in caves, and when they died their bones were buried in conditions that led to their preservation. Prehistoric men who inhabited caves also helped to form accumulations of fossils by throwing aside the bones of the animals on which they depended for food. For instance, Peking Man, the earliest known human being, must have hunted, killed and eaten buffalos, deer, and other animals that do not live in caves, for bones of these creatures were found in profusion in the cave in the hills near Peking where his own skull was found. Similar piles of bones, the refuse of prehistoric ages, have been dug out of the floors of caves in many other parts of the Earth.



A restoration of the sabre-tooth tiger, a ferocious creature that abounded in California in prehistoric times. Photograph by courtesy of the Carnegie Institution of Washington.

Other remarkable finds have been stores of mammoth tusks or "fossil ivory" on islands north of Siberia. Similar accumulations of elephants' bones and tusks in certain parts of Africa have given rise to the belief in "elephant cemeteries," swampy areas to which the creatures are supposed to retire to die. It is more probable that these finds of ivory are due to the inability of old and infirm elephants to extricate themselves from mud surrounding their drinking places, which then became veritable death traps.

All these hoards of relics of extinct creatures are fragmentary in comparison with the contents of a ruthlessly efficient natural death trap that has been operating at Rancho La Brea, Southern California, for countless centuries. Here surface pools of tarry slime have engulfed unwary animals in such numbers that more than 3,000,000 bones have been dug out of the beds. Fossilised remains of mammoths, mastodons, giant sloths, huge bears, and other formidable extinct creatures have been found in solid masses weighing many tons. The bones of sabre-tooth tigers and magnificent lion-like creatures of great size are specially numerous, and the drawing reproduced on this page gives a good idea of the power and ferocity of the former animal, which must have been one of the greatest terrors of prehistoric times.

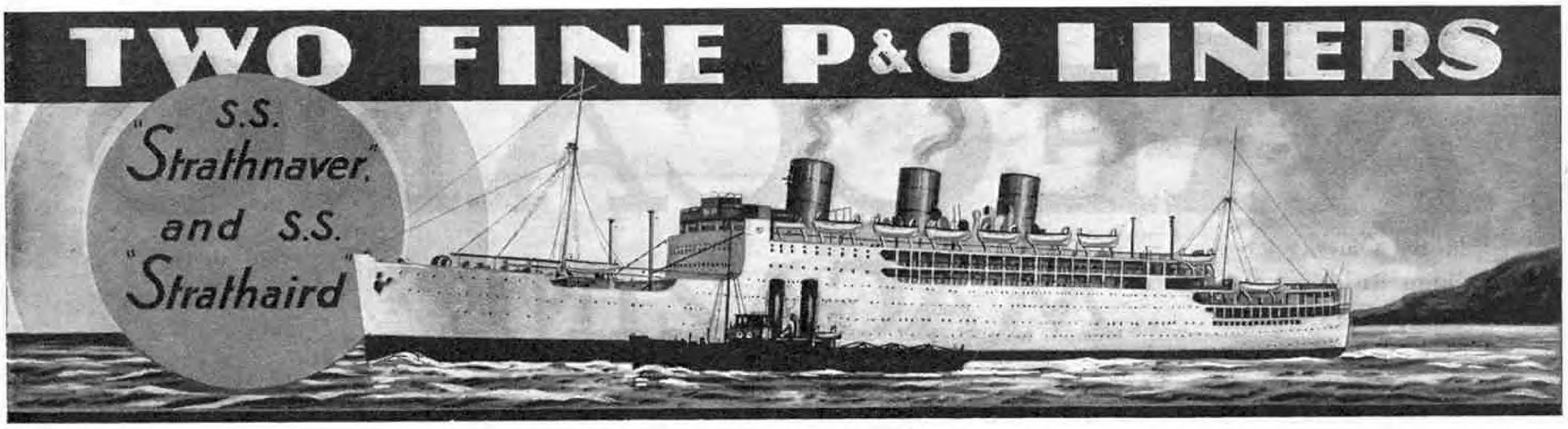
The discoveries at Rancho La Brea make a fascinating story, with which I hope to deal shortly in an illustrated article.

A Life Hobby Wasted

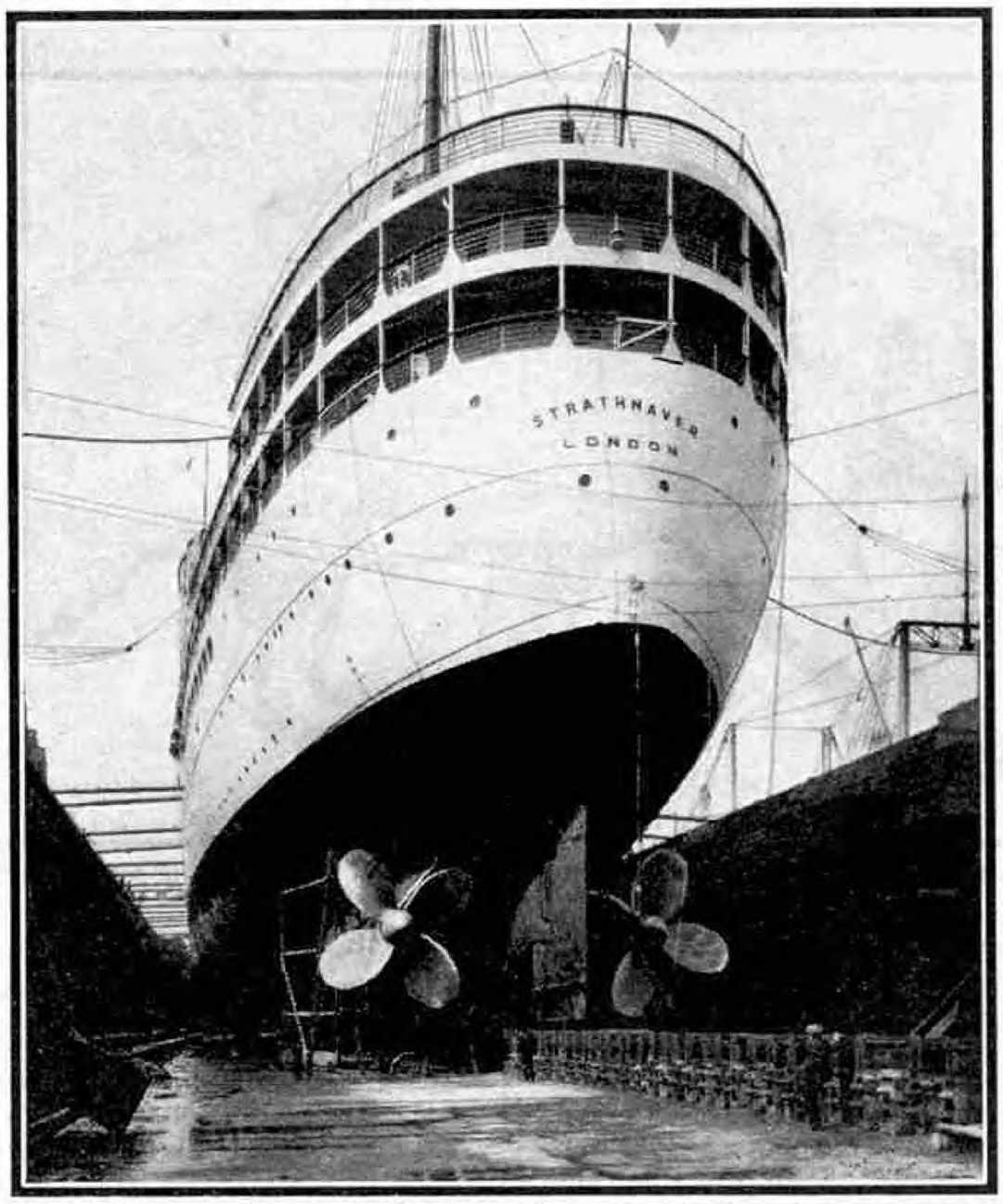
The number of different hobbies in existence to-day is surprisingly large, and at first sight bewildering in its variety. A little consideration shows, however, that if we exclude such hobbies as Meccano, model railways, fretwork and photography, the remainder resolve themselves into some form of collecting. These collecting hobbies of course vary greatly in accordance with the objects dealt with, but in every case the result aimed at is the acquisition of a complete set of something, whether it be stamps, coins, china, or furniture. Many men start a collecting hobby in boyhood and continue it all through life, so that by the time of their death they have acquired a valuable collection of their chosen objects. Only too often such a collection, deriving its interest from its completeness, is split up within a few months into small lots and sold. As a collection it simply ceases to exist, and the great advantages of seeing the units side by side and of being able to compare and contrast their chief features directly and easily are lost, perhaps for ever.

I was reminded of this recently by the announcement of the sale of what probably was the most complete collection of British stamps ever brought together. This was the property of Mr. H. P. Manus, of Amsterdam, who devoted to it the leisure hours of 70 years of his life. He began collecting as a schoolboy of nine, in the days when catalogues and albums were unknown. The foreign correspondence of his father's tobacco business provided him with a varied assortment of stamps, and it was not long before he had taken up the hobby in real earnest. His collection grew, and reached such dimensions that when he was about 50 years of age he decided to concentrate entirely on the stamps of the British Empire and divided his other stamps among his sons. Mr. Manus spared neither time nor money to achieve his ideal of completeness, and the collection created an unparalleled link between the pioneer collecting and advanced philately of to-day.

It seems a great pity that this unique collection is being broken up and scattered to all parts of the world. Its component parts will be added to the collections of many enthusiasts, but the collection itself, upon which so much care, thought and labour were lavished, vanishes and can never be replaced. How much better it would have been if the collection could have been purchased by one of our great museums, where it would have remained a perpetual delight to thousands of interested visitors who share the fascination of collecting, but are unable to acquire for themselves such rare and valuable stamps.



THE decision of the Peninsular and Oriental Steam Navigation Company in 1928 to adopt turbo-electric propulsion for their ship "*Viceroy of India*," attracted much attention, and the result was awaited with great interest. Apparently the performance of this fine vessel has been thoroughly satisfactory, for the company decided that their two latest ships, the "*Strathnaver*" and the "*Strathaird*," should also be electrically propelled. The new vessels have been built by Vickers-Armstrongs Ltd., and they are the largest vessels ever built for the P. & O. Line. Each is 644 ft. in length overall and 80 ft. in breadth, with a gross tonnage of 21,500 and propelling machinery of 28,000 S.H.P. The propelling equipment has been supplied by the British Thomson-Houston Co. Ltd., who also supplied that for the "*Viceroy of India*."



An impressive stern view of the S.S. "Strathnaver" in dry dock, that gives a good idea of the great height of the ship. This illustration and those on the opposite page are reproduced by courtesy of the British Thomson Houston Co. Ltd.

The "*Strathnaver*" and the "*Strathaird*" are identical in all essential details, and therefore we will describe only the former, which was also the first to be completed. The main propelling machinery consists principally of two separate turbo-alternator sets, each having its own condensing plant and auxiliary, supplying power to two double-unit synchronous motors coupled direct to the twin propeller shafts. The turbines are of the impulse type, designed for a maximum steam pressure of 425 lb. per sq. in., and a total temperature of 725 deg. F. They are fitted with stainless steel plating and nozzle plates throughout. The alternators are totally enclosed and self-ventilating. The ventilating air is forced through the machine by fans mounted at each end of the rotor, and after it is discharged it is cooled by air coolers mounted below the alternators before being again circulated through the machine. Embedded temperature detectors are provided to indicate the temperature of the internal windings.

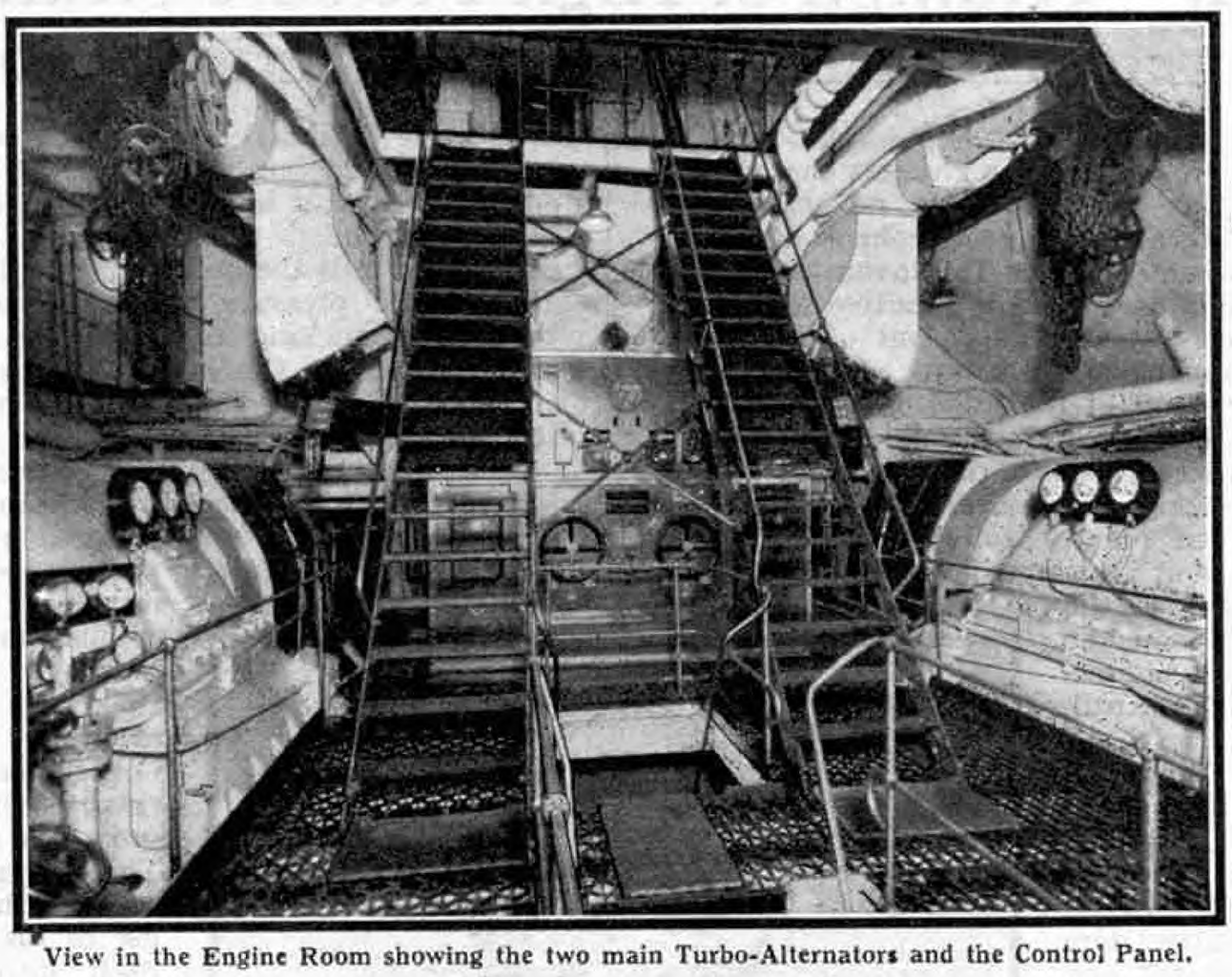
The term "double-unit," as applied to the propeller motors, means that each motor has two separate and distinct stator and rotor windings, and also two separate magnetic systems mounted in a common frame. In the event of one section failing electrically, it would be disconnected and the motor run at approximately half power. Fabricated steel construction is employed, enabling the frames to be made extremely rigid, but allowing the weight to be reduced to a minimum. The bearings are carried on facings provided on the fabricated endshields. They are self-lubricated by means of a disc, fitted on the shaft at the outer end of each bearing, and dipping into an oil well, and the deposited oil is wiped from the disc by means of a scraper and circulated through grooves in the bearing liner. The motors are ventilated by motor-driven centrifugal fans that draw the heated air from the motors and discharge it through air coolers into the motor room, from which it re-enters the motors through openings in the end-shields. As in the alternators, embedded temperature detectors are provided to indicate the temperature of the internal windings.

Two balancer booster sets are provided for obtaining from the 220-volt auxiliary bus-bars the power necessary for excitation purposes. One set suffices for all normal and manœuvring conditions, and the second set acts as a standby in case of emergencies.

Handwheels are provided at the forward end of each instrument panel for operating the isolators, to enable each alternator to be electrically connected to its propeller motor, or either of the alternators to be connected to both propeller motors. There are six levers arranged in groups of three, one group for controlling the port side and the other the starboard side. The two outer levers are direction levers for ahead or astern rotation of the propellers; the two inner ones are field levers for excitation of the alternators and propeller motors. The middle lever of each group is a

speed lever for controlling the speed of the turbines from dead slow to 330 r.p.m. The controls are interlocked so that incorrect switching is impossible, and no damage can be done to any portion of the equipment by an unskilled operator.

The steam generating installation consists of four Yarrow high-pressure water-tube boilers fitted with superheaters and tubular air-preheaters, working at a pressure of 400 lb. per sq. in. The steam is superheated to 725 deg. F. There are also two auxiliary boilers of similar design and type. The boilers are arranged to burn oil fuel.



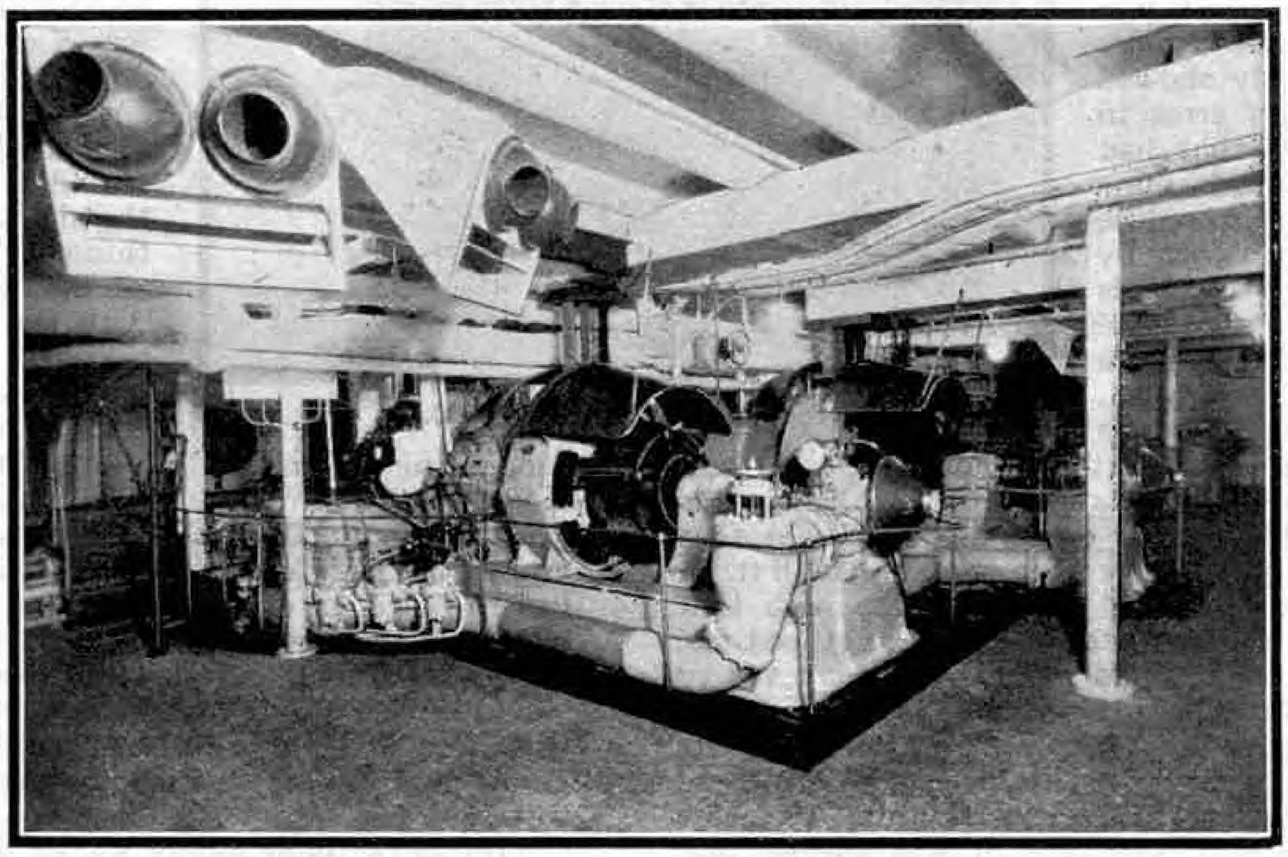
View in the Engine Room showing the two main Turbo-Alternators and the Control Panel.

The "*Strathnaver*" has a graceful appearance, with a straight stem raked forward, two masts, three streamlined funnels, and a cruiser stern. The hull is sub-divided by 12 watertight bulkheads, and the cellular double bottom is arranged for oil fuel, fresh water and water ballast. There are nine decks, including the boat deck, and the six uppermost of these provide promenading space for passengers. The rudder is operated by electro-hydraulic steering gear, with telemotor and automatic steering control from the bridge, and mechanical control from the docking platform aft.

Accommodation is provided for 498 first-class and 670 tourist-class passengers, and for officers, engineers and crew totalling 476. Of the first-class passengers 262 are in single-berth staterooms and the remainder in double-berth rooms. The main deckhouse on A deck is devoted to first-class single-berth staterooms, with a first-class promenade around, and on C deck are a special suite and 12 "de luxe" cabins, each with a private bathroom. Most of the first-class public rooms are on B deck, where there are the lounge, smoking room, reading and writing room, corridor lounge, veranda café, children's playground and nursery.

The first-class lounge is decorated in Italian style and is illuminated chiefly by a bronze metal grille that forms a band of light behind glass panels in the centre of the ceiling. The first-class smoking room is Scottish in design. The ornamental plaster frieze and ceiling have been copied from typical examples of Scottish architecture, and the chimney-piece has a wrought-iron grate that is a copy of one at Holyrood, Edinburgh. Another interesting feature of this room is a fine painted panel depicting Bonnie Prince Charlie raising his standard at Glenfinnan in 1745. Part of the open promenading space on B deck can be screened off to form a ballroom, and there are loud speakers for broadcasting dance music. At the end of C deck is the swimming bath, with hinged side screens and large sliding windows so that it can be converted into a semi-open air bath. The "swimmer's walk" adjoining the bath is paved with black and Irish green marble.

The tourist-class passengers are berthed in two-berth and four-berth rooms, with a lounge and promenade on E deck and a smoking room and promenade aft on F deck; and although the accommodation is less luxurious than that of the first-class passengers it provides a high standard of comfort. An open-air swimming bath and additional promenading space for tourist-class passengers are situated on D deck. The whole of the equipment and decoration of the passenger accommodation of the ship is on the most artistic lines, and the general appearance is strikingly handsome.



One of the 400 Kw. and two 750 Kw. auxiliary combined Turbo-Generator Condenser Sets.

The "*Strathnaver*" will be in tropical waters a great deal of her time, and special attention therefore has been paid to the ventilating of the passengers' and crews' quarters. The punkah-louvre system of Thermotank Ltd., has been installed generally for supplying air and warming it when necessary. Exhaustion of air is done generally by mechanical means.

The task of catering for nearly 1,200 passengers necessitates elaborate kitchen equipment, and that installed on this ship includes an electrically operated main galley range, 21 ft. long and 6½ ft. wide, and having 14 ovens. On the top of the range are 16 large and 24 small boiling pans. In addition there are two large double-deck electric baking ovens installed in the bakery. Mechanical aids include a potato peeler, various mixing machines, and electric dish and glass washers.

The navigating equipment of the "*Strathnaver*" incorporates the latest devices designed to ensure accurate steering under all

(Continued on page 317)

Trevithick—Father of the Locomotive

I.—Triumph of High Pressure Steam

RICHARD Trevithick, the centenary of whose death occurs on the 22nd of this month, was one of the greatest engineering geniuses this country has produced. He never became so well known as James Watt and George Stephenson, whose names are the first to be thought of when the invention of the steam engine and the introduction of the locomotive are being discussed. He improved Watt's steam engine out of all recognition, however, chiefly by raising the pressure and producing small but powerful engines instead of the huge ones of his predecessor. Then he placed his high pressure engine on wheels and made the first practicable locomotives to run on roads or on railways, more than 20 years before the appearance of Stephenson's "*Rocket*," the most famous of pioneer railway engines. He died in poverty and obscurity, but after many years of neglect he is now generally acknowledged as the true father of the locomotive and the inventor of the modern steam engine.

Trevithick was born on 13th April, 1771, in a house on the slope of Carn Brea Hill, in the parish of Illogan in Cornwall. Shortly afterwards his parents removed to Penponds, near Camborne, and there he afterwards went to school. He did not make a favourable impression on his schoolmaster, who described him as disobedient, slow, obstinate and inattentive. He preferred drawing lines and figures on his slate to taking part in the ordinary school lessons, with the result that his education never extended beyond reading, writing and arithmetic.

Young Trevithick had great ability in other directions, however, as he showed in the Cornish mine of which his father was manager. He was expected to occupy a desk in the office, but was happiest when allowed to wander through the workings, where he quickly showed his keenness by correcting an error in regard to underground levels that had puzzled the more experienced mine agents. He was sharp enough to realise that the compass needle is untrustworthy when in the neighbourhood of iron tools or machinery, and by making allowance for this he succeeded in laying down a course where the surveyors had failed.



Richard Trevithick, 1771-1833.

When Trevithick grew up he was 6 ft. 2 in. in height, and his great strength enabled him to perform feats of wrestling and weight-lifting that were unequalled in the district. Many stories are told of his exploits. It is said that on one occasion he picked up a heavy man, more than 6 ft. in height, turned him upside down, and raised him so high that the imprint of his shoes was left on the ceiling. At another time, when miner athletes were trying to lift a pump weighing seven or eight hundredweight, Trevithick surprised them all by hoisting it on his shoulder and carrying it away. He was able to write his name on a beam 6 ft. above the floor with his arm outstretched and supporting a 56-lb. weight attached to his thumb. His feats became almost legendary, in fact, and later it was alleged that he had thrown a 14-lb. sledge hammer so high above the chimney of a mine engine house that it never came down again!

In the meantime Trevithick had made his mark as a miner, and became a "captain," the name given in Cornish mining phraseology to an overseer or foreman. At the age of 18 he was the highest paid worker in the Stray Park Mine, one of those directed by his father. The elder Trevithick was one of the most enterprising and successful of Cornish mine managers, and for more than 20 years was in charge of several of the largest and most productive mines near Camborne. He is believed to have been the first to introduce the plan of working upward instead of downward in extracting ore, in order to avoid the inconvenience of standing in the water that inevitably collected in the mines. He was also a competent engineer, and it is interesting to find that in 1775 he re-modelled one of Newcomen's atmospheric engines then in use for pumping out water. In these engines steam at low pressure lifted a piston in a cylinder built above the boiler. The steam was then condensed by injecting cold water into the cylinder, and the piston was driven down by atmospheric pressure, the movement working the pump rods through a rocking overhead beam. Trevithick introduced a rounded top for the boiler in place of the flat cover previously employed, and by this simple means increased the pressure of the steam entering the cylinder, and made the engine more efficient.

"Captain Dick," as the younger Trevithick was familiarly known, was a capable all-round miner, but was chiefly interested in the engineering work required in mining operations. A great struggle was then taking place between James Watt, the Scottish inventor and pioneer of the steam engine, and Cornish engineers who had developed Newcomen's engine. In more than one mine Watt's engines were at work side by side with those of Cornish engineers and there was great rivalry between them as which should prove the most efficient and economical. The struggle became fiercer when Watt accused his rivals of making illegal use of his patents, and finally resolved itself into a series of lawsuits that ended in victory for Watt, but this success only came a year or two before his patents expired.

Trevithick played a leading part in this struggle. On one occasion Watt took exception to an engine that his Cornish rival had erected at Ding Dong Mine, near Penzance, and caused printed notices forbidding its use to be placed on the door of the engine house. This scared off the enginemen, but Trevithick retaliated successfully by altering the design of the engine completely. He turned the cylinder upside down and placed it right over the pump rods in the shafts, instead of allowing it to act through a pivoted beam, a method almost universal at that time.

In the engines then in use the steam pressure was only a few pounds per square inch, and a vacuum was created on the opposite side of the piston by condensing the steam in a separate chamber, on the principle introduced by Watt. While endeavouring to avoid infringing Watt's patents, Trevithick hit on the idea of a high-pressure engine, and he immediately asked a scientific friend if there would be any loss of power in employing steam at a pressure of several atmospheres, if the steam were allowed to escape instead of being condensed after doing its work. He was assured that the loss of power would only be that due to the pressure of the atmosphere, and that in partial compensation he would gain by not having to work an air pump to create a vacuum, and by doing without condensing water.

Trevithick immediately set to work with characteristic energy and ingenuity to build an engine on this new plan, and it is said that within a month several high-pressure engines were in operation. In these engines steam at high pressure forced the piston along the cylinder, and was exhausted into the atmosphere on the return stroke. Engines of this type came to be known as "puffers," from the noise of their exhausts; and they were the first engines in which high-pressure steam was definitely employed to give movement.

Trevithick's next step was to turn his high-pressure engine to account in raising ores from the mines. Only once previously had any attempt been made to use engines of the older type for this purpose, and this effort, made by Watt himself, had proved a failure. Trevithick experienced no difficulty in designing a high-pressure engine to pull up the heavily-laden kibbals, or trucks

of ore, and even worked out a plan for turning the kibbals upside down above the wagons into which the ore was to be loaded.

When he was 25 years of age Trevithick took the first step towards the invention of the locomotive, for then he constructed a model engine designed to run round a room under its own power. The boiler and cylinder of this engine were in one piece, and steam was raised by pouring hot water into the boiler and placing a red hot iron in an inner tube. This novel plan was adopted for the purpose of avoiding the production of unpleasant fumes in the room where it ran.

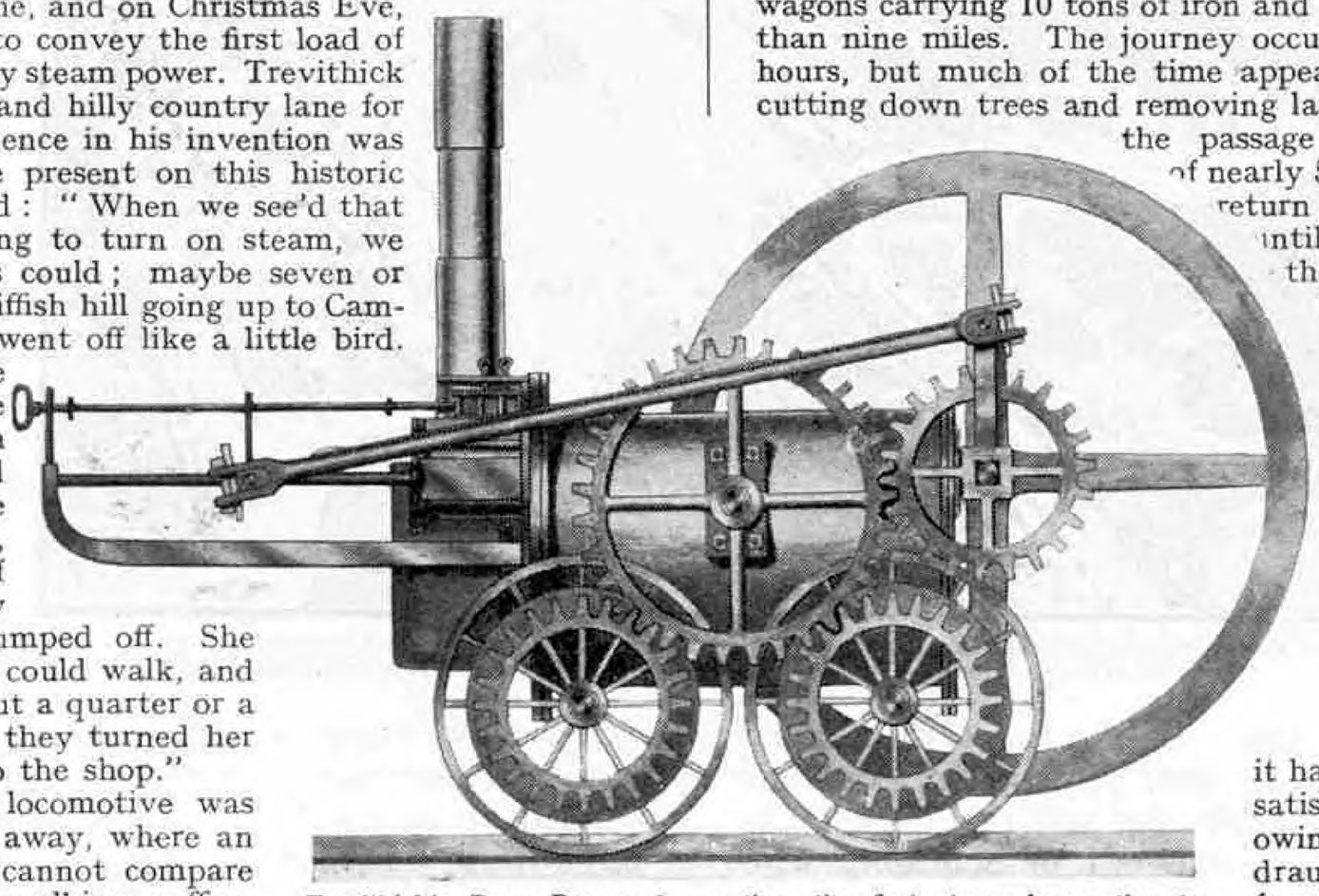
This model was followed by others, and one of these is now in the Science Museum, South Kensington. The boiler of this engine is cylindrical, and contains an oval tank closed at the inner end, into which an iron block fits. When the model was to be operated the block was heated in a fire and placed in the tank in order to raise steam. The cylinder is vertical, 1.55 in. in diameter by 3.6 in. stroke, and is sunk in the boiler. The piston rod ends in a crosshead, provided with connecting rods reaching down to crank pins attached to the two driving wheels, which are 4 ft. in diameter. A spur wheel on the crankshaft drives a pinion on the shaft of a flywheel that rotates at three times the speed of the driving wheels. The steam distribution to the cylinder is controlled by a four-way cock operated by a tappet motion from the crosshead, and a small safety valve is kept down by a simple spring.



Trevithick's home at Penponds, Camborne. This interesting relic of the brilliant inventor has been converted into a Trevithick Museum.

For two years Trevithick continued his experiments with models, although he was in want of money owing to the depressed condition of mining in Cornwall at this time. Finally he decided to build a steam carriage to run on the roads. This was erected in a smith's shop in Camborne, and on Christmas Eve, 1801, was brought out to convey the first load of passengers ever moved by steam power. Trevithick boldly chose a difficult and hilly country lane for the trial, and his confidence in his invention was justified. One of those present on this historic occasion afterwards said: "When we see'd that Captain Dick was agoing to turn on steam, we jumped up as many as could; maybe seven or eight of us. 'Twas a stiffish hill going up to Camborne Beacon, but she went off like a little bird. When she had gone about a quarter of a mile there was a roughish piece of road covered with loose stones; she didn't go quite so fast, and as it was a flood of rain and we were very squeezed together, I jumped off. She was going faster than I could walk, and went on up the hill about a quarter or a half mile further, when they turned her and came back again to the shop."

Next day the road locomotive was taken to Crane, a mile away, where an old lady cried out "I cannot compare 'un to anything but a walking puffing devil." It was then driven to Tehidy Park, the house of a great mineowner, but something broke just before it reached its destination.



Trevithick's Pen-y-Darran locomotive, the first steam locomotive to run on a railway.

Enough had been done to show that Trevithick's road locomotive was a complete success, however, and in great jubilation the inventor, and his friend and partner, Vivian, went to London in order to obtain a patent. This proved difficult, and it was not until 24th March, 1802, that they were granted a patent for steam engines for propelling carriages.

In the meantime a second series of trials were carried out in Cornwall, and a greater experiment was made in the streets of London. Needless to say, the appearance of a locomotive in the capital caused a great sensation. One day Vivian ran it from Leather Lane, Gray's Inn Lane, to Lord's Cricket Ground and Paddington, returning through Islington, a journey of about 10 miles. On other trips a speed of eight or nine miles an hour was reached, and on one occasion the engine ran so well that in joke the partners talked of keeping on until they reached Cornwall! The ambitious travellers were immediately brought to a standstill, however, by colliding with a wall owing to faulty steering. Unfortunately the trials had to be abandoned owing to lack of money.

Although no practical results came of Trevithick's trials with his road locomotive, they helped him to realise that a smooth road was essential if a steam locomotive was to work smoothly and efficiently. From now onward his thoughts were turned to railway locomotion, for plateways and railways were already in existence in many parts of the country, providing smooth iron roads along which wagons were hauled by horses.

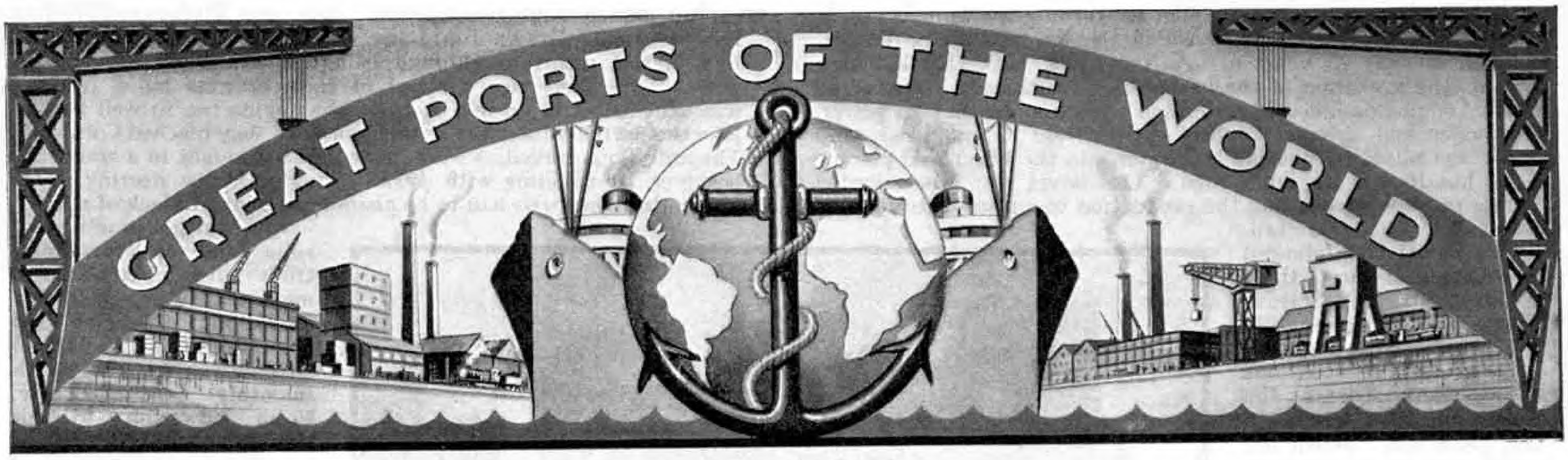
Trevithick was convinced that horses could be replaced with great advantage by his steam engine, and in the autumn of 1803 he was given the opportunity of putting his ideas into practice at Pen-y-Darran in South Wales, where he built a locomotive to run on a colliery plateway. This locomotive was completed in time to undergo its first trial in the following February, and Trevithick was then able to write exultantly: "It works exceedingly well and is much more manageable than horses. We have not tried to draw more than 10 tons at a time, but I doubt not we could draw 40 tons at a time very well; 10 tons stands no chance at all with it."

A few days later Trevithick's locomotive hauled a train of five wagons carrying 10 tons of iron and 70 men for a distance of more than nine miles. The journey occupied a few minutes over four hours, but much of the time appears to have been occupied in cutting down trees and removing large rocks that interfered with the passage of the engine. A speed of nearly 5 m.p.h. was reached, and the return journey was equally successful until the breaking of a bolt caused the water to run out of the boiler.

Trevithick's Pen-y-Darran locomotive was the first of its kind to run on the railway, and its design included many of the features which, in the hands of George Stephenson and other railway pioneers, helped to make steam locomotion successful. One of these features was the steam blast. Until the appearance of Stephenson's "*Rocket*," it had been difficult to raise steam satisfactorily in locomotives, owing to the absence of a good draught, and the success of that famous engine was in great part due to the fact that the exhaust steam from the cylinders was discharged into the chimney, thus providing a forced draught through the fire that became more effective as the speed of the locomotive increased. Stephenson has been hailed as the originator of this device, which played such a vital part in the development of railways, yet Trevithick's Pen-y-Darran locomotive, built 26 years earlier, had a blast pipe that discharged steam from the engine up the chimney, about 3 ft. above the fire.

Fifty years later, when Trevithick's son visited the works in which the Pen-y-Darran locomotive was built, an old workman picked out of a scrap heap

(*Continued on page 286*)



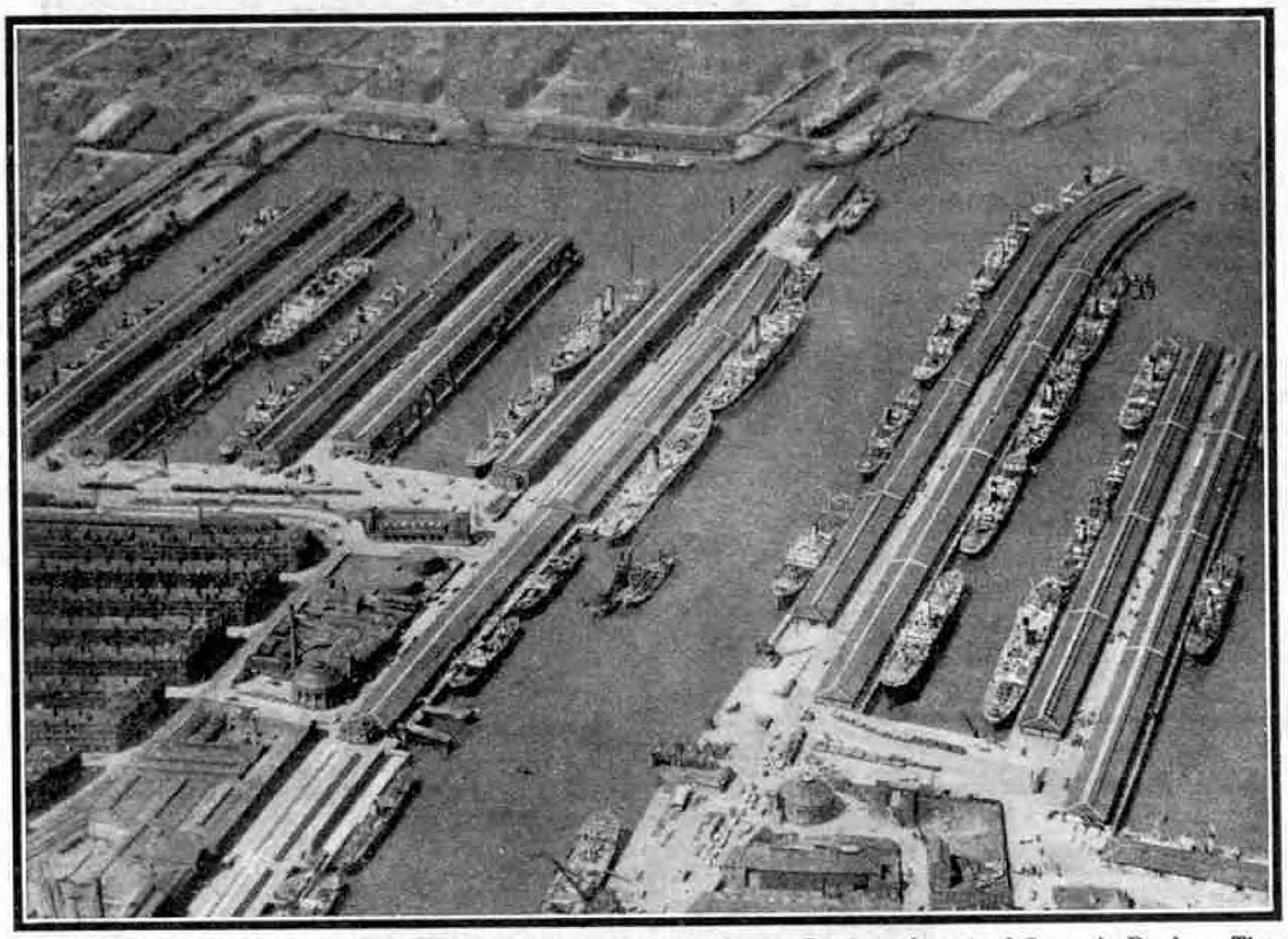
III.—GLASGOW

GLASGOW dates back to at least the 6th century, for it was there that Kentigern, the patron saint of the city, as a young man lived for se eral years as a nermit. He taught Christianity to the rough Celts of Strathclyde and built at what is now Glasgow a small wooden church on the spot where the present fine cathedral stands. As the influence of his teaching spread it is probable that his converts gathered round his abode, and that in this way the population of the village—for it could have been nothing more—gradually increased. Under the care of the monks it gradually became a place of importance, but nothing definite is known about its history until the 12th century.

In 1175 the Bishop of Glasgow obtained from William the Lion the grant of a Royal Charter constituting the community that had gathered round the Cathedral Church into a burgh or barony, or "borough" as it is called in England. A few years later the same Sovereign granted the right to hold a fair annually in July, and this right is exercised to the present day. Before the 17th century there was little trade of any kind in Scotland, and few or no manufactures. Its trade did not really begin to develop until the time of James VI of Scotland, who became King of England in 1603.

In those days the river was not navigable as far as Glasgow, and the nearest port was at Irvine, 40 miles away on the Ayrshire coast. The conveyance of goods by lighters from there to Glasgow was tedious, and transport by land carriage was expensive; and in 1658 the magistrates of Glasgow endeavoured to purchase ground at Dumbarton in order to construct a harbour there. The inhabitants of Dumbarton objected, however, and pleaded that "the great influx of mariners and others would raise the price of provisions to the inhabitants." The Glasgow magistrates then sought some other suitable site, and in 1668 they purchased 13 acres of ground on the south side of the river at a point 18 miles west of the city. On this site they constructed a harbour and called the place Port-Glasgow. Twenty years later a quay was built at Glasgow, in the part known as Broomielaw.

In the middle of the 16th century Glasgow ranked eleventh in population and importance among Scottish cities and towns, but by the close of the 17th century it had risen to second place. At that time the population totalled between 10,000 and 11,000. Trade had greatly increased, owing chiefly to the monopoly of the sale of raw and refined sugars for most of Scotland that the inhabitants had secured about 1650. In addition to this they carried on a considerable trade in cured herrings and salmon; they manufactured soap, and sent hides and linen to English ports, from which they brought back in exchange tobacco and manufactured goods.

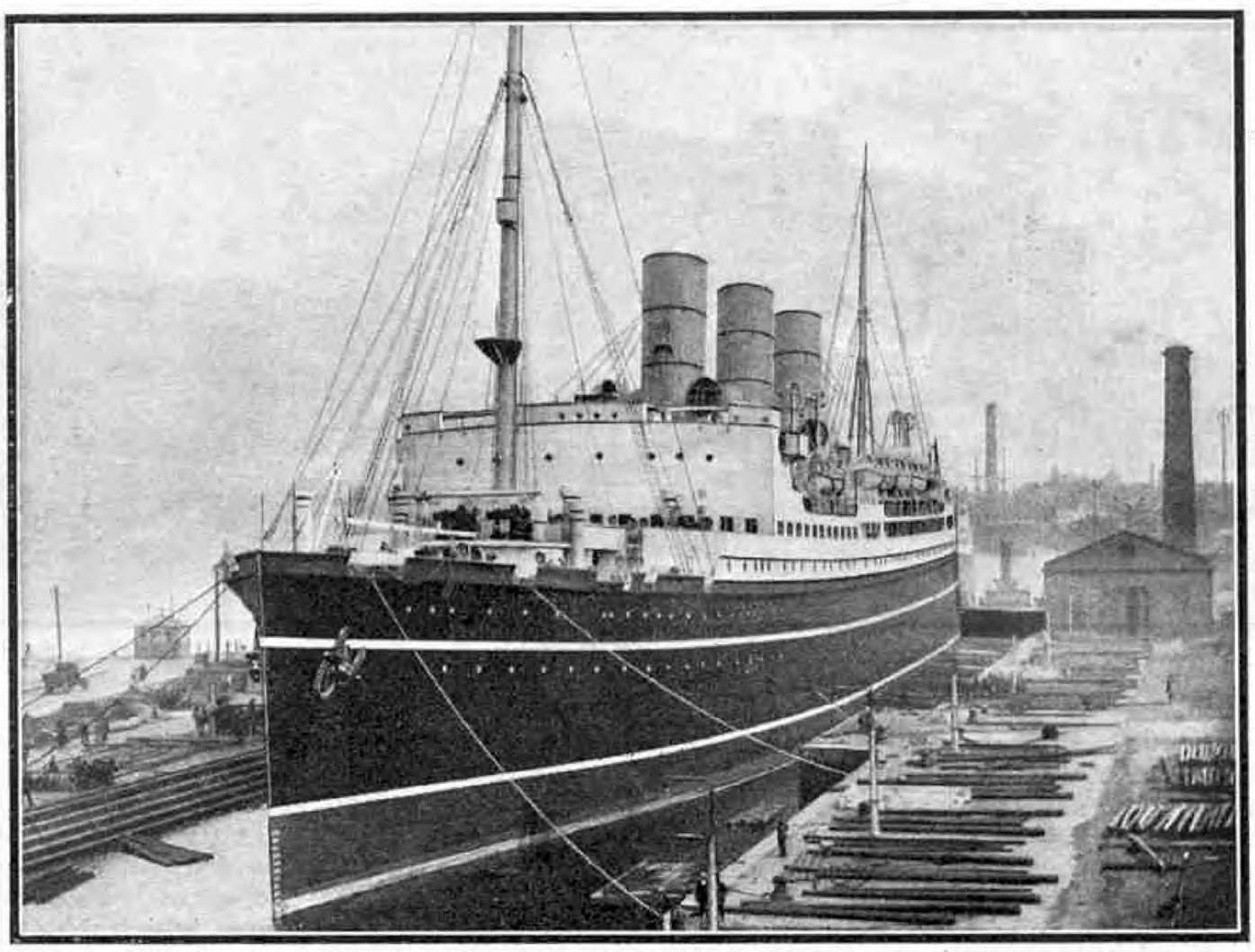


Aerial view of Glasgow Harbour, looking west, showing Prince's Dock and part of Queen's Dock. The illustrations to this article are reproduced by courtesy of the Clyde Navigation Trust, Glasgow.

After the union of Scotland with England, the merchants of Glasgow began to take part in the highly profitable tobacco trade with American colonies that was already carried on extensively by Bristol and Liverpool, and a large trade was soon established. Ships were chartered, and out of the profits of the early transactions other ships were built. The ships of the Glasgow merchants sailed regularly to Virginia, Maryland and Carolina with miscellaneous cargoes that were bartered for tobacco. By 1760 Glasgow had completely rivalled Bristol in the tobacco trade, and by 1772 it imported more than half the entire quantity brought into the kingdom. The growth of this profitable trade was reflected in the rapid extension of the city, while the money earned found its way into other branches of commerce and stimulated new industries. When the tobacco trade received a

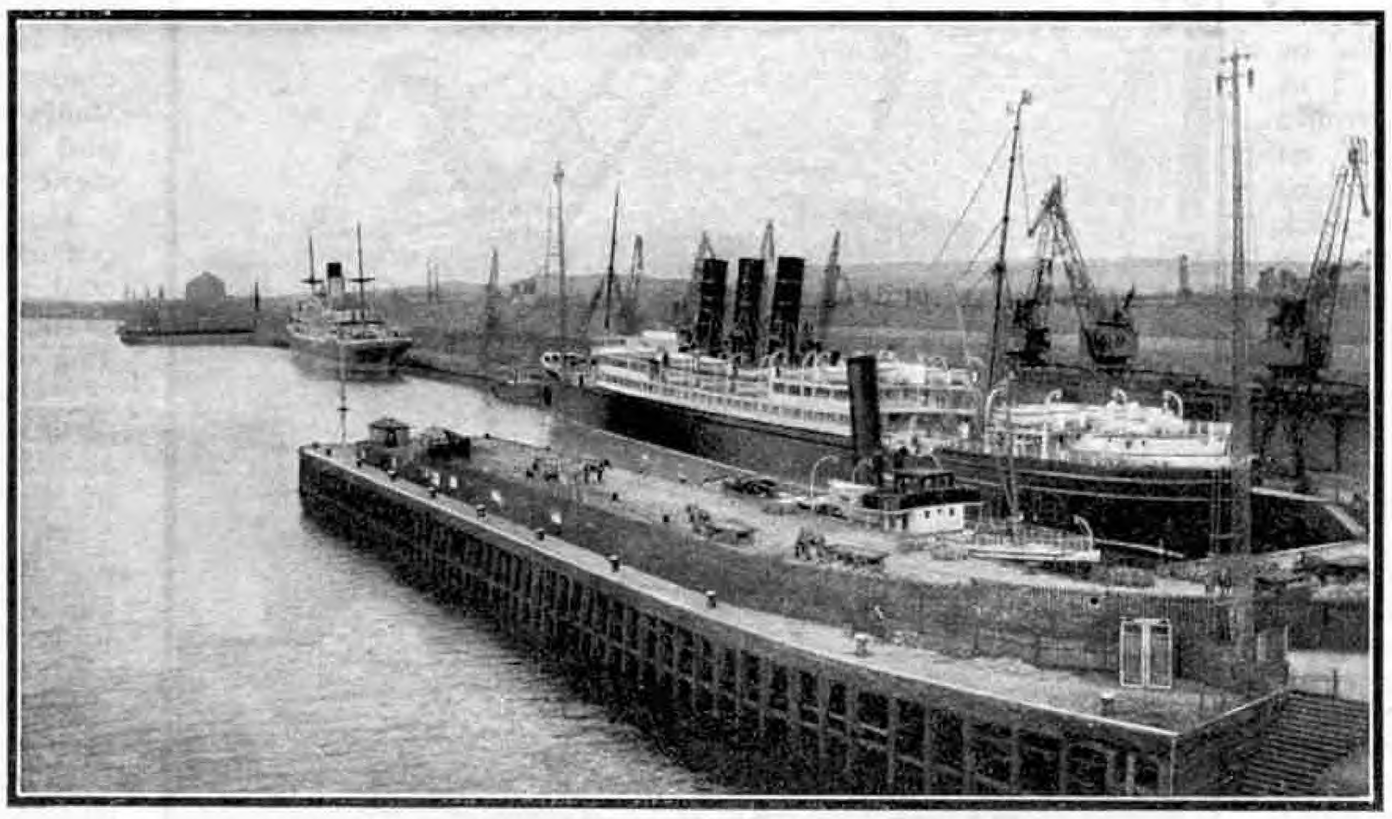
crushing blow at the outbreak of the American War of Independence in 1775 the Glasgow merchants turned their attention to trading with the West Indies. By the close of the 18th century the population of the city totalled close upon 80,000.

The construction of the harbour at Port-Glasgow did not solve the problem of deepening the river, which was still a shallow, wide and winding stream that could be forded easily at several places for half the distance between Glasgow and the sea. The magistrates of the city did not tackle the matter in earnest until well into the 18th century. The first attempt towards deepening the river was made in 1740, and there is an interesting reference to it, dated 8th May of that year, in the minutes of the Town Council. The entry states that "the Council agree that a tryal be made this season of deepening the River below the Broomielaw and remit to the Magistrates to cause do the same and go the length of £100 sterling of charges thereupon and cause build a flat-bottomed boat to carry off the sand and shingle from the banks."



Canadian Pacific liner "Empress of Canada" entering No. 3 Graving Dock for repairs.

Fifteen years later the magistrates decided to consult an engineer on the subject of improving the river, and they selected John Smeaton, who is chiefly remembered for his Eddystone Lighthouse. Between Glasgow and Renfrew, a distance of five miles, Smeaton found no less than 12 shoals, four of which were only 18 in. in depth at low water. He formed so poor an opinion of the possibilities of the river that he suggested the construction of a weir and lock at Marlinford and the canalising of the four miles of river between there and Glasgow Bridge, so that vessels drawing up to 4½ ft. of water might pass to and from the quay at Glasgow. Smeaton's suggestions were not adopted, however, and this eventually proved fortunate for the port.



The deep water berth of the Anchor Line at Yorkhill Quays.

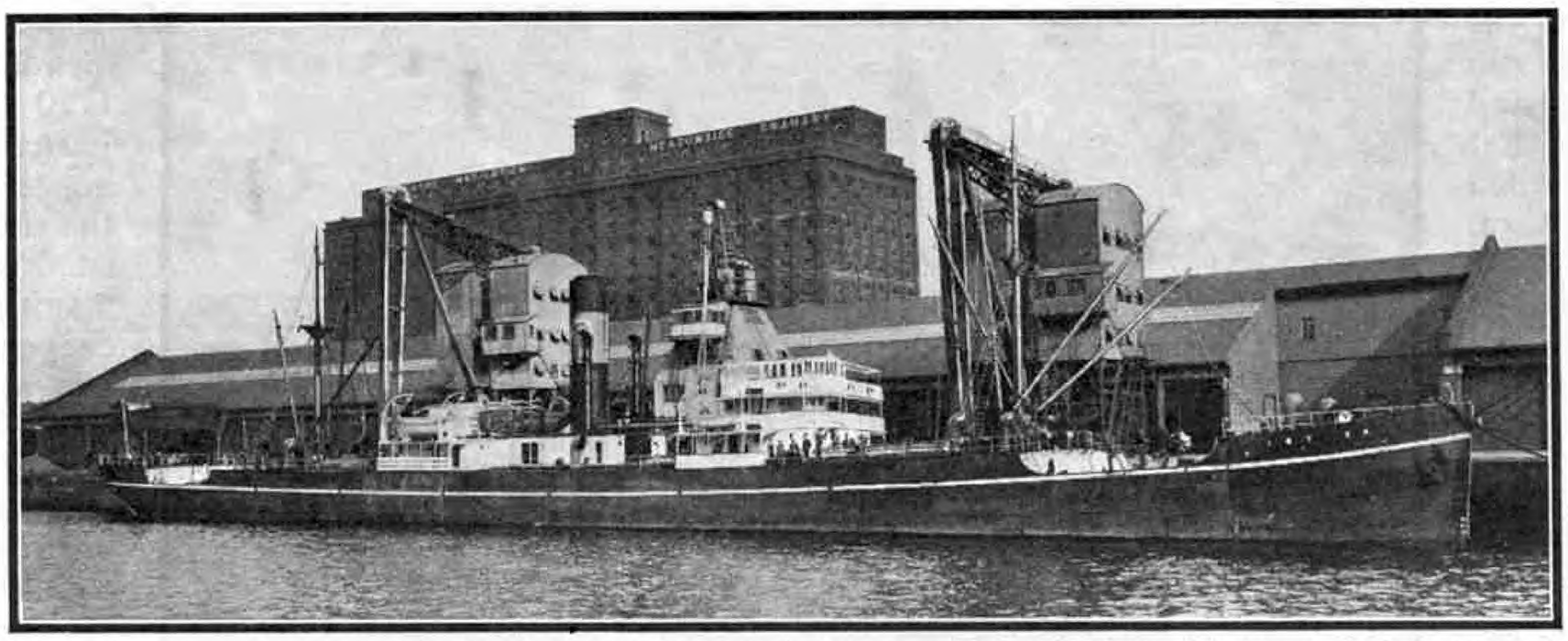
The next step the magistrates took was to consult John Golborne, of Chester, in 1768. He advocated the principle of assisting nature by removing the stones and hard ground from the river bottom at the shoals, and by contracting the waterway by means of rough stone jetties, so that the strength of the current would be increased and the channel scoured deeper. Apparently before coming to a decision the magistrates sought further advice, for the next year they consulted James Watt. Finally they adopted Golborne's recommendations, and in 1770 the first Act of Parliament authorising the deepening of the river was obtained. This Act gave the magistrates power to deepen the river to 7 ft. at high water of neap tides. About 220 jetties were constructed on Golborne's plan, and in course of time the spaces between these jetties silted up and the river assumed a more regular and defined course.

Subsequently, on the advice of the famous engineers John Rennie and Thomas Telford, the ends of these jetties were connected by longitudinal dikes of loose stones. This system of training walls served its purpose well, and the only fault that can be found is that its originators took too limited a view as to the widths that should be preserved in the river; in consequence much waterway was lost, and the Trustees have had to recover by purchasing, at heavy cost, land that was reclaimed from the river by the operations of their predecessors.

In order to get the full benefit of the scour caused in the river by the training walls, ploughs and harrows were used to break up the bottom wherever hard. The work progressed slowly, as in those days powerful mechanical dredging plants had not come into use. In 1812 Henry Bell's "*Comet*," the first steamer built at Port-Glasgow and the pioneer of British steam navigation, grounded at Renfrew, although drawing only 4 ft. of water. It is recorded that Mrs. Bell, who was on board when the grounding occurred, on being asked what happened, replied: "Oh, the men just stepped over the side and pushed her across the shoal."

Until 1809 the harbour and river were managed by the magistrates and the town councillors of Glasgow. In that year an Act was passed creating them Statutory

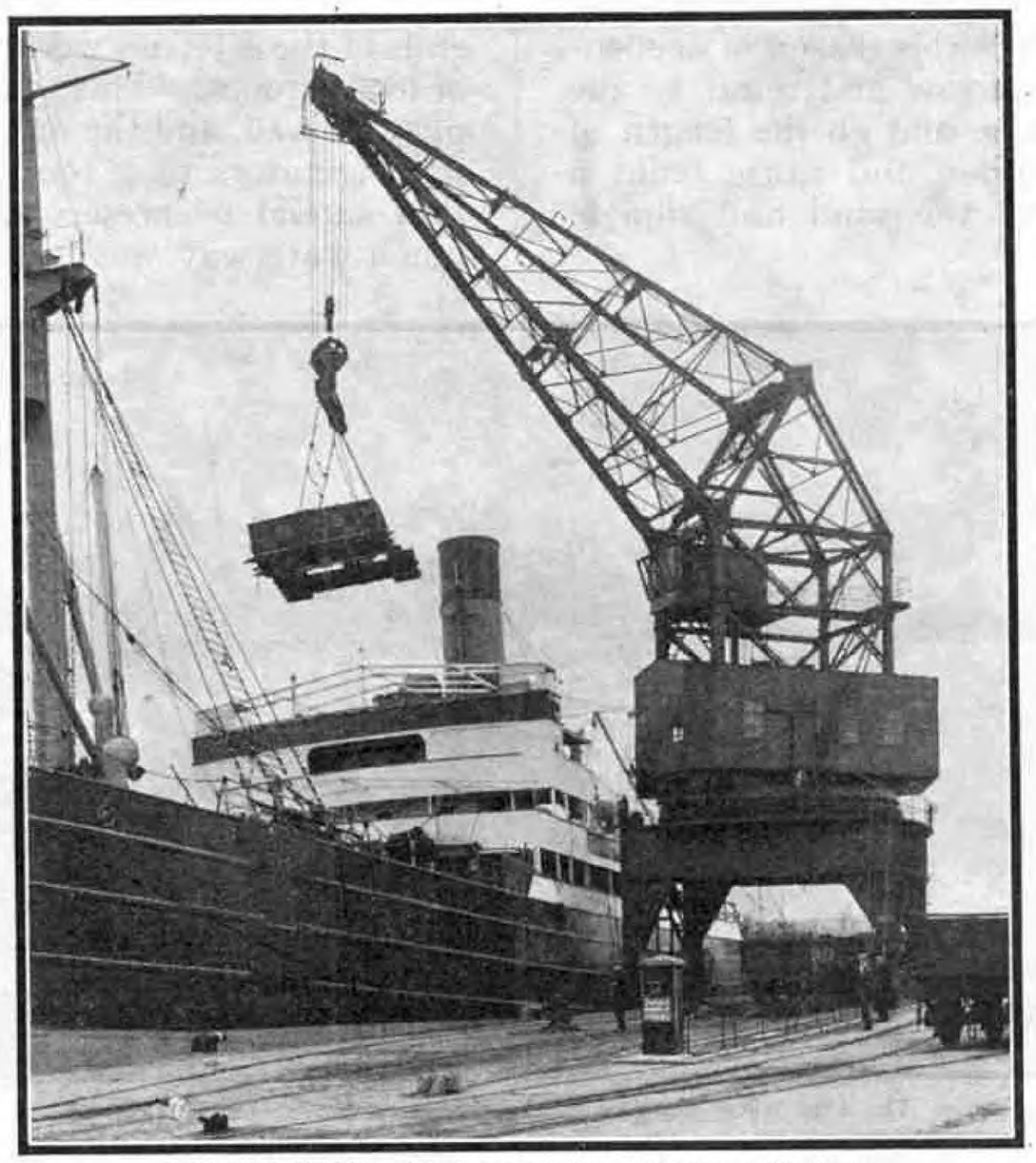
Trustees, which they continued to be exclusively till 1825 when, under an Act of that year, five other persons interested in trade and shipping were added. The interests represented were further widened at later dates. One of the first tasks of the newly-appointed Trustees to the Clyde Navigation was to continue and extend the work of deepening and widening the river. The ploughs and harrows were subsequently succeeded by hand-worked dredgers, and in 1824 an important advance was made by the introduction of the first steam dredger, a machine capable of working to a depth of 10½ ft. below water line. This greatly speeded up the work, and by 1836 the river at Broomielaw Quay had been deepened to 12 ft. at high water of neap tides, which was sufficient to enable ships of 400 tons to sail up to Glasgow. In 1840 Parliament sanctioned an Act for the further improvement of the navigation of the Clyde under the supervision of the Trustees. By 1854 vessels of 19 ft. draught could be safely navigated to and from the harbour, and by 1870 vessels of 22 ft. draught could reach Glasgow.



Discharging a cargo of grain by means of pneumatic and bucket grain elevators at Meadowside Quay. The granary in the background provides storage accommodation for 31,000 tons of grain.

For many years the quays along the river front were sufficient for all requirements, and it was only when the available frontage was all utilised that the Trustees turned their attention to constructing a dock. The question then arose as to whether the dock should be of the closed or the tidal type. Glasgow is situated 22 miles from the sea, and has a tidal range of only about 10 ft. A closed dock would have meant that the entrance and exit of ships would be restricted to a limited period at high water, and that there would be considerable congestion of shipping in the river. The Trustees therefore decided that the dock should be a tidal one, so that ships would be free to enter or leave it at any state of the tide, and the likelihood of congestion in the river would be greatly reduced. This tidal dock, known as the Kingston Dock, has a water area of 5⅓ acres, and was completed in 1867.

The overseas trade of the port increased more rapidly than the dock accommodation, and a second tidal dock, now known as the Queen's Dock, was completed in 1880 at a total cost of £1,163,000. It has a water area of 33⅓ acres, and a total of 3,334 yds. of quay. The dock is used by many famous lines of ocean-going steamers.



A 40-ton Electric Coaling Crane at work, Glasgow Harbour.

Eventually these two docks became insufficient to cope with the increasing shipping, and the construction of a third tidal dock was put in hand. The Prince's Dock, as it is called, consists of an outer basin and three inner basins. The first section was opened in 1893, and the dock was completed by 1900. It has a total water area of 35 acres, and 3,737 yds. of quay. The west quay is used chiefly by new ships fitting out after launching and a 130-ton steam crane is provided. The Prince's Dock also forms a regular berth for the transatlantic ships of the Donaldson and other well-known lines.

In time still more accommodation became necessary, especially for the large mineral traffic of the port, and the Trustees therefore built a new dock at Clydebank, about six miles below Glasgow Bridge, for this traffic. The dock is called the Rothesay Dock, and it was completed in 1907 at a total cost of £700,000. It is equipped with 21 four-ton cranes and two transporters for dealing with the discharge of iron ore and other minerals, and there are four 32-ton hoists and one 32-ton crane to deal with the shipment of coal., All the machinery, consisting of dock hoists, cranes, capstans and turntables, is operated by electric power generated at a station erected for the purpose by the Trustees. The Rothesay Dock was the first dock in existence to have a complete electrical equipment of its kind.

In 1905 the Statutory Trustees of the Clyde Navigation were succeeded by a new constitution, consisting of an incorporate body of 42 Trustees representative of all interests concerned with trade and shipping and the welfare of the West of Scotland generally, who give their services free.

Glasgow is conveniently situated in a commercial and shipbuilding centre, surrounded, within a radius of 20 miles, by numerous coalfields and ironworks. The varied commerce of the port reaches impressive figures, which show that in normal times as much as 10,000,000 tons of goods were imported and exported in a year, with revenues exceeding £1,000,000 per annum. But Glasgow, like all other ports, is at present suffering from the financial crisis that has dislocated the trade of the world.

The port is well equipped with the most modern facilities for the reception and shipment of all classes of goods. Storage accommodation for imported general goods includes single and double storey sheds from 55 ft. to 100 ft. wide and with a total floor length of eight miles.

Mineral traffic, that is the importing of ore and the shipment of coal, is naturally a very important branch of the trade of the port, and as just mentioned, the Rothesay Dock is equipped specially to deal with these commodities. In addition to the coaling appliances at this dock there is a 40-ton electric crane at Prince's Dock, and at Queen's Dock there are two electric cranes of 32 tons and 35 tons capacity respectively. In normal times the coal exports of the port total about 4,000,000 tons a year.

Glasgow is an important grain-distributing centre both for the whole of Scotland and the northern part of England and also Ireland. The granary, adjacent to Meadowside Quay, is equipped on the most modern lines and provides storage accommodation for 31,000 tons of grain. The grain is discharged from the ships by one electrically operated travelling-bucket elevator and two pneumatic elevators, and thence conveyed to the granary by band-conveyors. Delivery of grain can also be made by band-conveyors to small vessels or lighters, or in sacks or bulk direct to road vehicles or railway wagons. The largest tonnage of grain, flour and meals imported in one year since the granary was opened in 1914 was 784,347 tons in 1917.

Great quantities of fruit are imported into the kingdom by way of Glasgow, where there is

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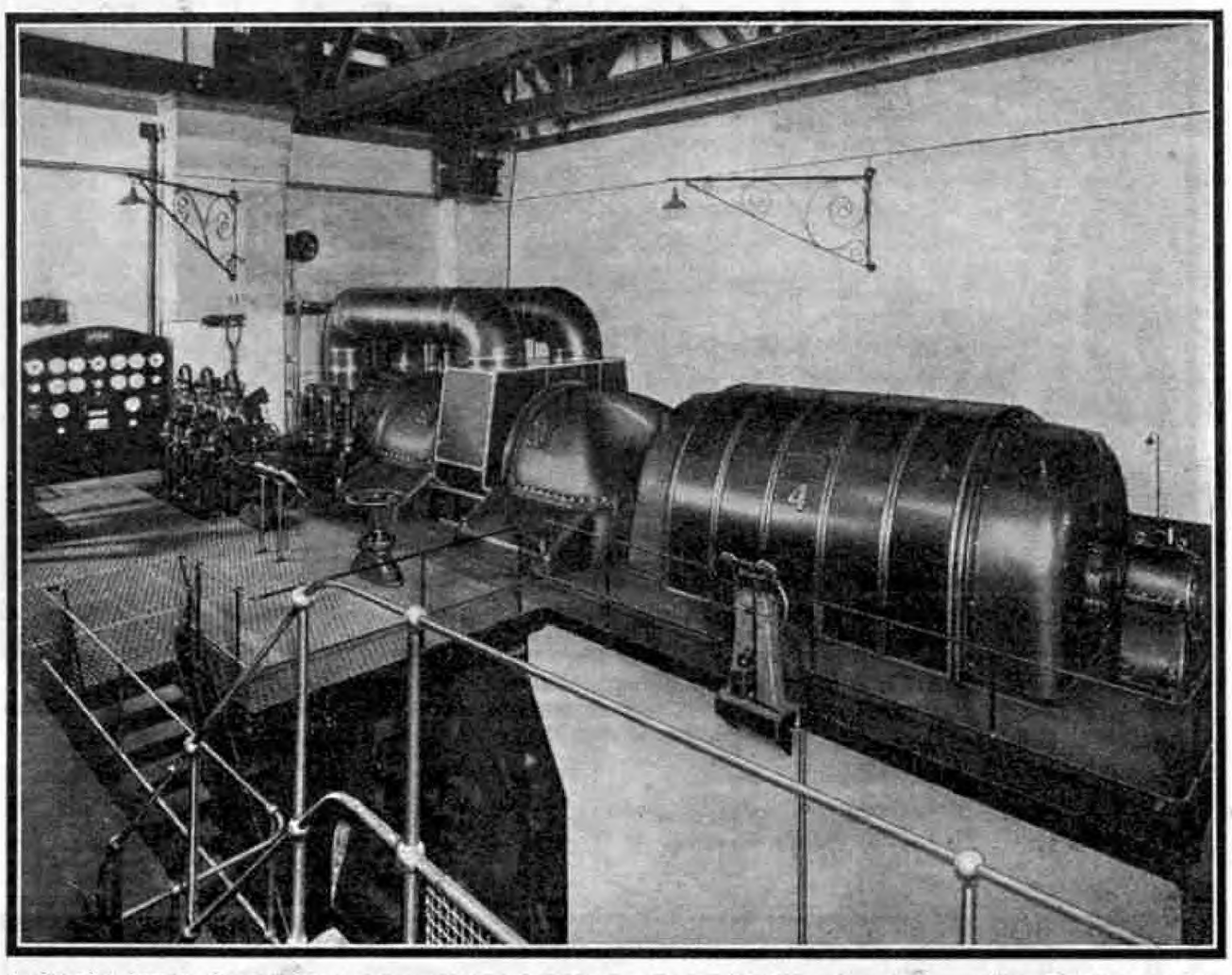
A Modern Turbo-Alternator

Generating Current at 6,600 Volts

THE steam turbine has been mainly responsible for the great progress that has been made in the generation of electrical power on a large scale, for on account of its very high speed of working it forms an ideal means of driving the huge alternators used in modern power stations.

It is only in comparatively recent years, however, that the turbine has come into prominence for land work, although the principle on which it operates has been known for hundreds of years. Even so long ago as 120 B.C. the Alexandrian philosopher Hero described an apparatus that really was a simple form of reaction steam turbine. In this apparatus steam was admitted through a hollow pivot shaft to a spherical body provided with hollow bent arms, and the steam escaping from these arms caused the spherical body to rotate. In 1609 an Italian, Giovanni de Branca, proposed to utilise the kinetic energy of steam escaping from a nozzle for rotating a bladed wheel.

The practical application of steam turbines depends, however, in a very high degree on materials and workmanship ; and it is no doubt due to lack of both that it was not until the end of the 19th century that much progress was made in their development. With the gradual perfecting of machine tools it became possible to do more accurate work, and in 1884 the late Sir Charles Parsons built a successful turbine that operated at 18,000 revolutions per minute and developed 10 h.p. From this time onward several British engineering firms devoted their attention to the development of the turbine and its application to electric power production. One of these was Fraser & Chalmers Engineering Works, an old established firm that now is one of the associated concerns controlled by the General Electric Co. Ltd. This firm concentrated on what is known technically as the "impulse" turbine, to distinguish it from another type known as the "reaction" turbine.



A 30,000 K.W. Turbo-Alternator at the Battersea Power Station, London. The Turbine section is shown on the left-hand side of the photograph, and the Alternator on the right. Part of the special ventilation plant can be seen in the foreground beneath the control platform.

In an "impulse" turbine the steam is allowed to gain a very high speed by expanding it to a low pressure in a series of nozzles the cross section of which gradually gets smaller. The effect of passing the steam through these nozzles is to turn the energy of the high-pressure steam into energy of motion of a rapidly rushing steam wind. This wind blows on and through a ring or wheel of curved moving blades, and its passage causes the ring to revolve at a very great speed. The steam then passes through a ring of stationary blades fixed to the case in which the turbine runs. These blades, or diaphragms as they are called, come down between two rings of the moving blades, which are fixed to the turbine shaft ; and their purpose is to swish the steam round so that it can blow in the right direction on a second moving wheel. There are a number of successive rings of these fixed and moving blades, and all the moving rings are mounted on one shaft and are known collectively as the "rotor."

One of the great advantages of turbines for land work is their extremely high rate of revolution and absolutely smooth running. These two considerations make them ideal motive units for driving dynamos, the armatures of which have to be turned very rapidly and smoothly. Nowadays huge alternators are used in place of the older direct current machines, and the generator shaft is coupled direct to the rotor of the turbine. This combination of power unit and generator is now used in nearly all important electricity stations.

A typical example of a huge 30,000 K.W. turbo-alternator plant of this type is shown in the accompanying illustration. This plant is installed at the Battersea Power Station, London, and was built by G. E. C.—Fraser and Chalmers, to whom we are indebted for our photograph. It develops about 40,000 h.p. in electrical energy, at 6,600 volts, and the current is then passed through transformers that raise the pressure to 132,000 volts for distribution to various parts of London through oil-filled underground cables.

The turbine plant is made in two sections, one of which is driven by the high-pressure steam direct from the boilers and the other by low-pressure steam. Steam is fed from the boilers to the high-pressure turbine at a pressure of 300 lb. per square inch, and a temperature of 750° Fah. After passing through the first turbine, the steam passes to the second turbine, where it is admitted in the centre and passes in both directions through duplicate sets of wheels until finally it reaches a condenser, in which a state of very high vacuum is maintained. Here the steam is reconverted to water, which is then pumped back to the boilers to be once again turned into steam and so utilised again in working the turbines.

The two turbine rotors are coupled together and in turn coupled to the rotor of the alternator, and the whole rotating mass, weighing about 30 tons, spins round at 3,000 revolutions per minute, i.e., 50 times every second ! The speed through space of the rim of the largest wheel of the turbines is 1,000 feet per second, which is approximately 680 miles per hour, a speed that is equivalent to going from London to Brighton in 4½ minutes!

The stator of the alternator, which is the heaviest single part of the machine, weighs 64 tons, and is built up from a large number of thin plates stamped out to shape and clamped together. The windings of the machine consist of copper bars instead of wire owing to the amount of current to be carried. Although there are such heavy weights flying round at enormous speeds, the whole machine is so perfectly balanced and free from vibration that the uninitiated are unable to tell whether it is working or not, and it is so accurately controlled with automatic governors that the speed does not alter in the slightest degree. For this reason it is possible to connect electric clocks to the electricity mains, and these clocks keep very accurate time, being really controlled by the governors of the great turbines at the generating station.

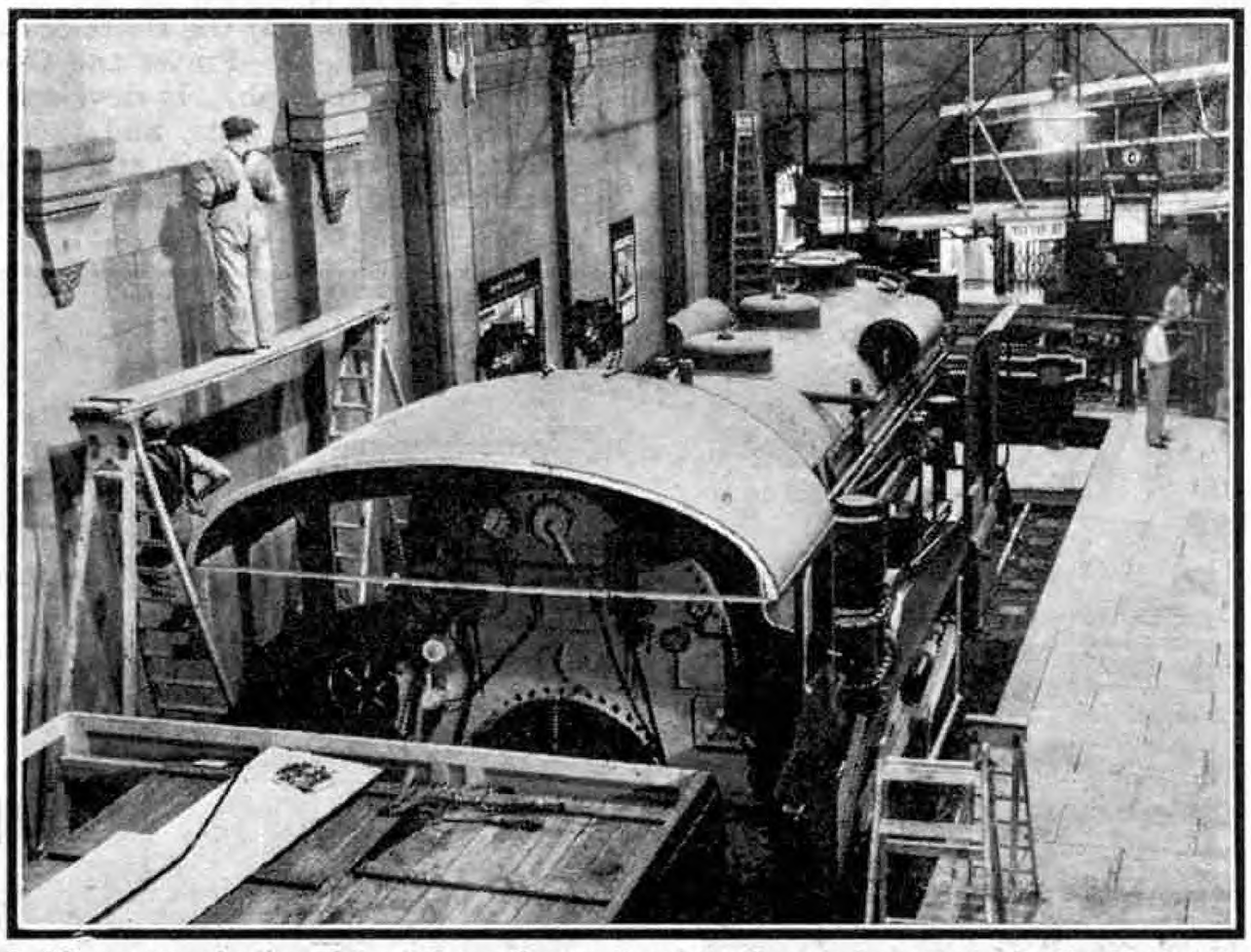
Upon the design and manufacture of the rotor depends to a large extent the successful running of a turbo-alternator. Perfect balance, efficient ventilation and absolute rigidity are of the greatest importance, while the need for great mechanical strength, in view of the rotation of great masses at high speed, is a matter of prime necessity. Usually, therefore, the rotor is a solid forging machined and very carefully wound, the winding coils being completely shaped before they are embedded in the slots. The current is brought to the windings by means of two steel slip-rings shrunk on to an iron sleeve, from which leads are connected

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How "*Rome Express*" was Filmed

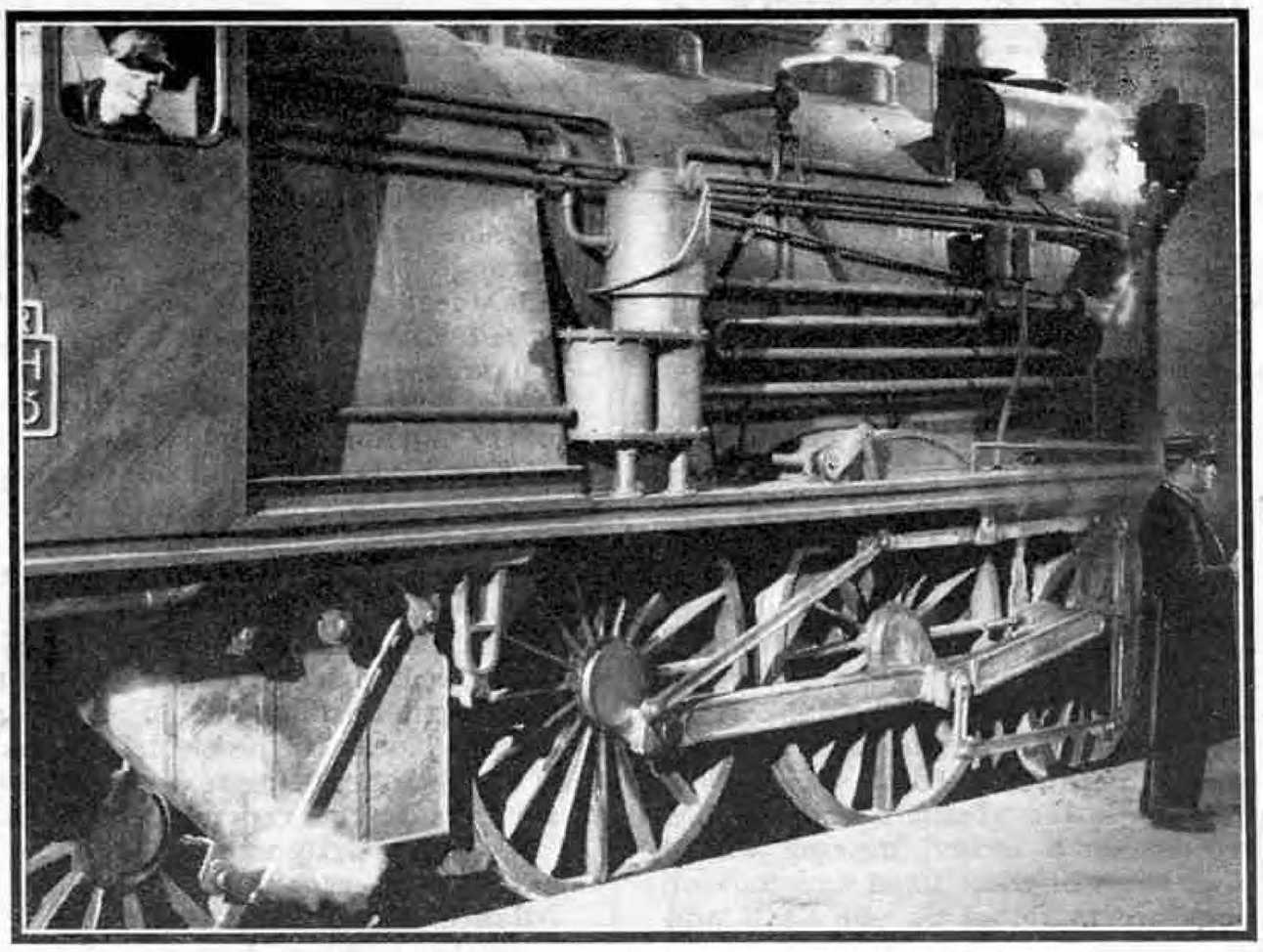
A Transcontinental Journey in a Studio

THE splendid new film studios at Shepherd's Bush of the Gaumont-British Picture Corporation Ltd., were completed last year, and are now in full swing. They are the largest studios in Europe, and it is fitting that the first film made in them has set a new high standard of film production in this country. This picture, entitled "*Rome Express*," deals with a series of exciting happenings during one night on the Paris to Rome express, and, with the exception of a little exterior photography, the film was made entirely in the studios. The work was carried out under the direction of Walter Forde, the well-known film producer who made that fine railway film "*The Ghost Train*," described and illustrated in the "*M.M.*" of December, 1931.



Building a reproduction of the "Rome Express" and the Gare de Lyon station in the Shepherd's Bush studios. The illustrations to this article are reproduced by courtesy of the Gaumont-British Picture Corporation Ltd.

A few facts about the real "*Rome Express*" will be of interest before we pass on to the making of the film. This express is a famous Continental *train-de-luxe* linking the French and Italian capitals, and it incorporates second-class as well as first-class sleeping accommodation. It connects with the 11 a.m. "*Golden Arrow*" service from London, and conveys through coaches from Boulogne. Until May of last year it ran through from France to Italy by way of the Mont Cenis tunnel, but the Simplon tunnel is now traversed.



The finished engine, a masterpiece of British studio craftsmanship.

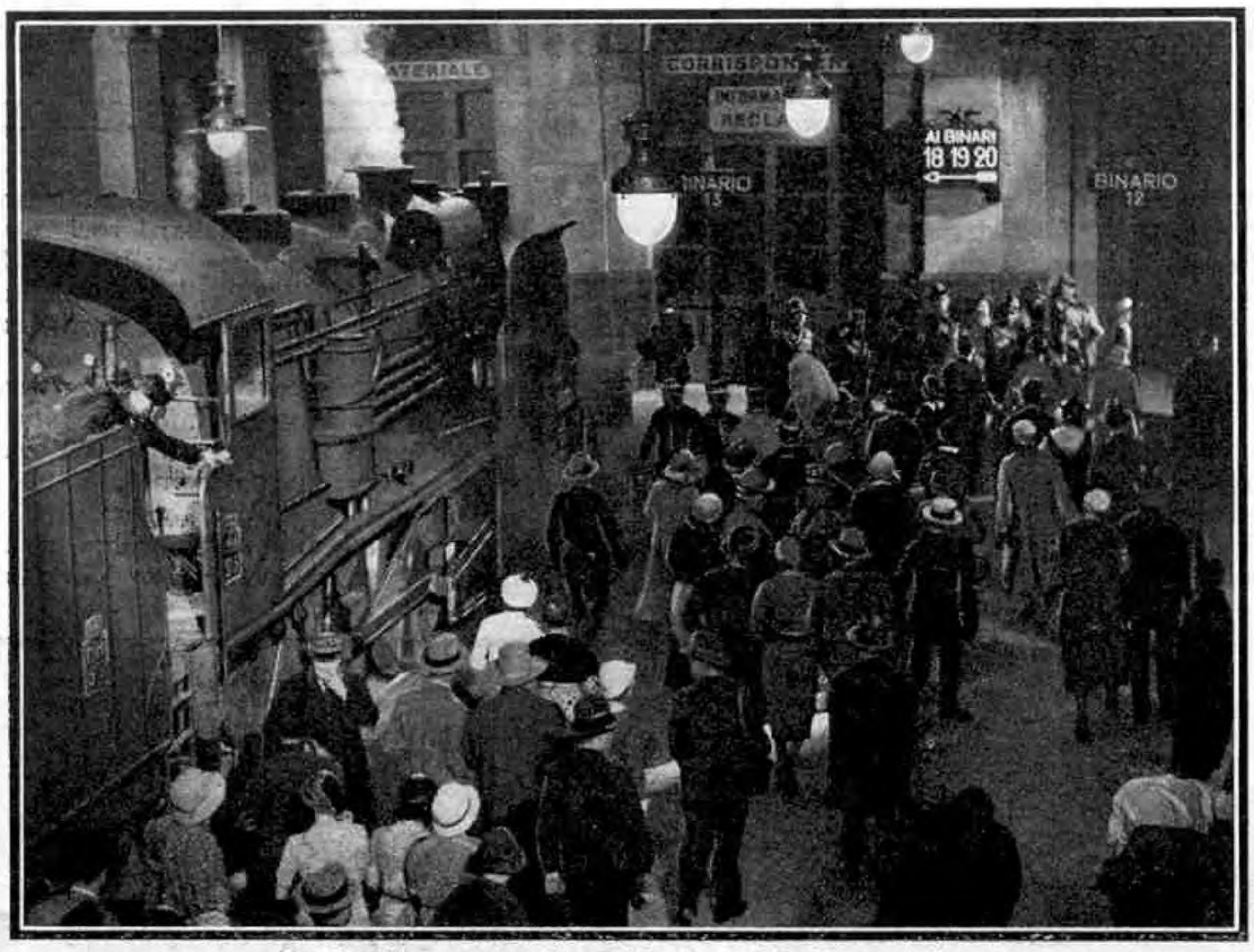
This change of route has resulted in acceleration between Paris and Rome, for whereas the present departure and arrival times are 8.50 p.m. and 8.40 p.m. respectively, just 10 minutes short of 24 hours, they were previously 5.15 p.m. and 6.45 p.m. The alteration was agreed upon in 1931 with the Swiss Federal Administration by the P.L.M. and Italian State Railways, Swiss interests being now included, whereas previously French and Italian companies only were concerned. The alteration and acceleration of the train were made in view of the possible effects of the opening of the Italian "direttissima" line through the Apennine tunnel, giving considerable advantage to the through trains from the French Est system via Basel and the St. Gotthard route. The Italian share of the general speed-up involved an acceleration of 115 minutes between Turin and Rome, while the steam-operated stretch of 196¼ miles between Leghorn and Rome are covered non-stop.

Leaving the P.L.M. terminus at the Gare de Lyon, Paris, the "*Rome Express*" travels by way of Laroche and Dijon to the Swiss frontier at Vallorbe. Here the Swiss Federal system takes charge, and from this point the train descends to the north shore of the lake of Geneva at Lausanne, then on to Brigue at the mouth of the Simplon tunnel. This tunnel consists of two bores, the first of which was commenced in 1898, although the proposal to construct the tunnel dated from 1857. It was finished in 1905 after considerable difficulties had been overcome. To relieve the stress on the first bore owing to the heavy traffic, and to guard against the possible dislocation of traffic in the event of the single bore being blocked from any cause, a second tunnel was started in 1912. Owing to the interference of the War it was not finished till 1921.

After this 12.3 mile bore has been threaded, the Italian State Railways take charge at Domodossola, whence

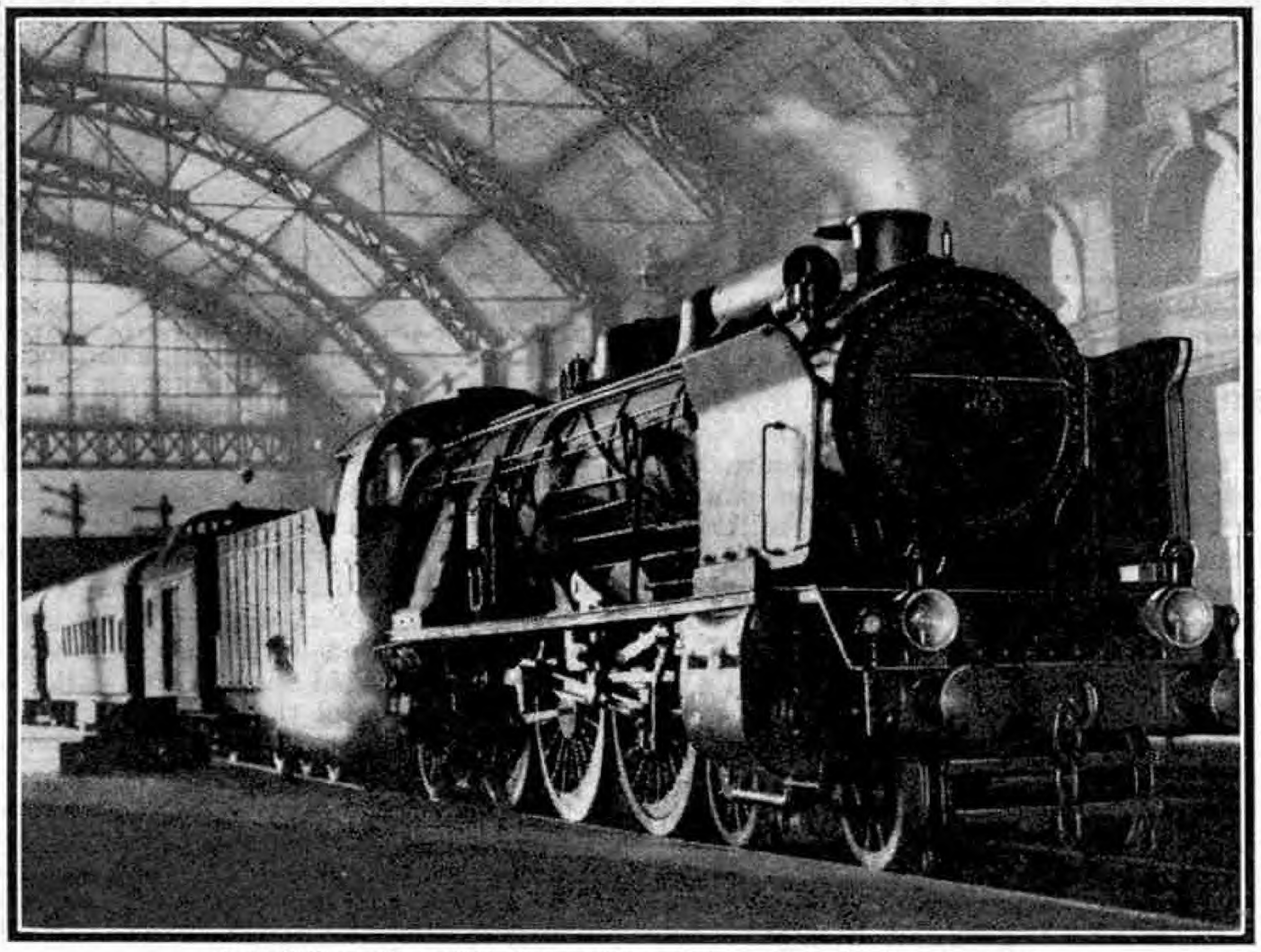
the train proceeds on its journey to Rome.

The formidable task of constructing in the film studios a correct representation of the interior of the Gare de Lyon station, Paris, and of part of the Paris to Rome express, did not dismay the designers, carpenters and others of the production staff concerned, and everybody worked with an enthusiasm that commanded success. The company went to great trouble to ensure accuracy of detail, and a cameraman was sent to Paris to take a large variety of photographs of the station, to serve as a basis for the construction of the sets. The principal studio, which has an area of 9,000 sq. ft., was then converted to resemble the interior of the Gare de Lyon, Paris. The representation was complete down to train arrival and departure indicators, a tobacco kiosk and a *bureau de change*; and further realism was gained by a typical display of advertisements obtained from the P.L.M. Publicity Department at Lyons.



Looking down on the "crowd" scene at the Rome station.

A complete coach and luggage van were constructed to almost correct dimensions by the studio carpenters, and were arranged to occupy one platform. An ordinary passenger coach corridor is too narrow for the modern movie camera, and therefore the corridor of the studio-built coach was made exceptionally wide so that the camera could be moved along it when necessary. A studio-built locomotive was stationed alongside a second platform. A 4–4–2 type engine with four-wheeled tender, was used for most of the film, but a small scale model "Pacific" engine, made by a London firm of model-builders and placed at the head of a small model train built by the studio carpenters, was used for certain "shots." This miniature train stood under a glass station roof and looked wonderfully realistic, and of course when seen in the film it appears to be full size.



A realistic studio model of the "Rome Express" in the Gare de Lyon.

Another set in the studio represented the interior of the van, in which a quantity of passengers' luggage was contained. At the point in the film where this set is used the express is rushing on its way, and to produce the effect of high speed the whole set was rocked while this part of the film was being shot. The manner in which the scenery was made to flash past was very ingenious. Actually the views seen from the guard's van were photographed from the luggage van of the real express as it travelled between Genoa and Pisa, and several journeys over the route were made by Mr. Forde and the camera staff in order to pick out and photograph the best of the scenery. At the studio this film of the scenery was projected on to a screen erected at the rear of the set and was re-shot as the action took place. The synchronisation of the re-photographed scenery and the train called for very great skill, but it was successfully accomplished. Ample supplies of smoke and steam were kept available for use when shooting scenes in which the train was supposed to be in motion.

The ingenuity of the producers was further demonstrated by the method adopted to show the lights of the train as it travelled through the country at night. A countryside model 40 ft. long, and including trees, fields, hills, farms and houses, miniature railway stations and telegraph poles, was assembled on one of the stages. The entire model was painted a very dark grey. A track was laid down parallel to it so that a mobile camera could be moved along in front of the set. The lights in the studio, with the exception of a spotlight attached to the camera, were then extinguished, and a large board with apertures cut to the shape of carriage windows was stood between the spotlight and the model. The camera and board were then moved simultaneously, and the bright reflection thrown on to the model was photographed as it passed over the countryside.

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The World's Greatest Suspension Bridge

Span of 3,500 ft. Across the Hudson River

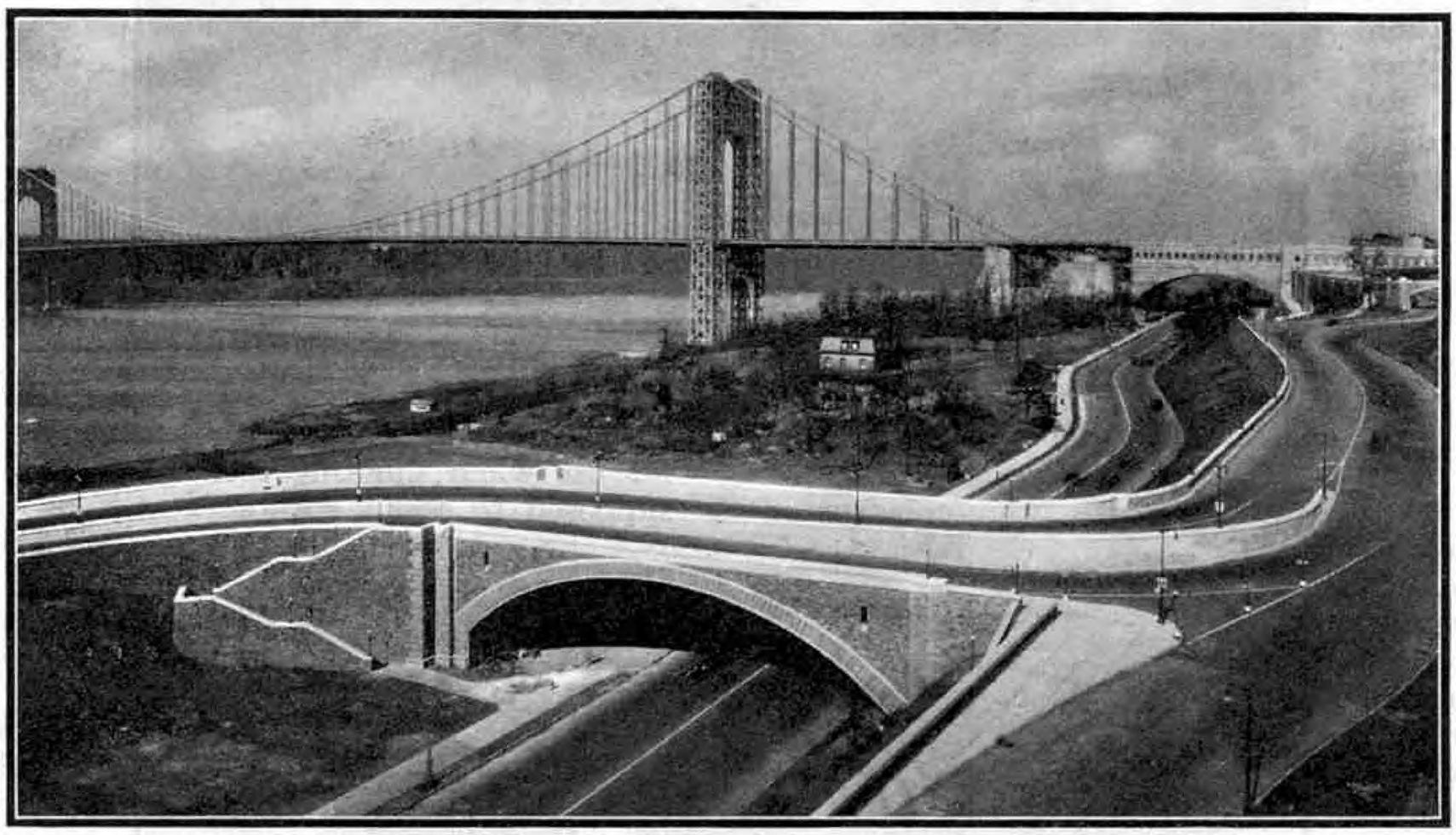
WITHIN the bounds of the city of New York there are more great examples of the bridge-builder's art than exist anywhere else in the world in a region of equal size. In that city there are close upon 60 bridges and viaducts, and after a glance at the map it is not difficult to realise why bridges should be such a prominent feature. The central portion of the city is built on an island 22 square miles in area. Manhattan Island, as it is called, is a narrow rocky ridge two miles in width, cut off from the mainland on the north by the Harlem River, and separated from New Jersey on the west by the Hudson River, nearly a mile in width. On the east is a large island called Long Island, the arm of the sea separating it from Manhattan Island being named the East River. On three sides, therefore, Manhattan Island is bounded by wide rivers, while the point, on which the famous sky-scrapers are erected, juts out into the large expanse of water constituting New York Harbour.

Until 1883 ferryboats provided the only means of transport across the rivers. In that year Brooklyn Bridge, or the "Great Bridge" as it was then called, was completed, giving direct access to Brooklyn on Long Island. This bridge is of the suspension type, and has a central span of 1,595 ft. and a total length of 6,016 ft. The volume of traffic across the rivers, particularly across the East River, increased at such a rapid pace, however, that eventually it became necessary to construct other bridges at various places along the river. The need of a bridge over the Hudson River was not felt very greatly before the time of railways, for the ferry-boats were sufficiently large and numerous to meet the demands for both passengers and freight. By degrees, however, as traffic increased on the great trans-continental railways—all but one starting from the west side of the Hudson River—a demand for a more rapid crossing of the river sprang up.

In 1887 the Pennsylvania Railroad began to consider the idea of spanning the river with a bridge, and the first serious investigations in this direction were carried out for the company by Samuel Rea and Gustav Lindenthal, who came to the conclusion that a bridge was feasible but that it would be necessary for it to have a single span over the entire river. The Hudson River is more than twice as wide as the East River and the idea of a single span double the length of the Brooklyn Bridge, the longest span then in existence, appeared to many engineers to be impracticable. As the science of bridge construction advanced, however, it became evident that Lindenthal's plans for a single-span bridge were quite sound.

In 1910 the Interstate Bridge and Tunnel Commission, a joint body of the states of New York and New Jersey, considered the possibility of constructing a cantilever road bridge 1,400 ft. long across the Hudson River in the vicinity of 178th Street, New York. It was intended that the main piers of the bridge should be built in the river, but borings revealed that great depths of soft earth had to be penetrated before hard rock was reached, and the project was abandoned. Subsequently the Hudson Vehicular Tunnel, described in the *"M.M."* of February and March, 1930, was constructed 10 miles farther south, and this relieved the traffic problem to some extent.

In 1923 the subject of a bridge across the Hudson River was revived, and two years later the states of New York and New Jersey authorised the Port of New York Authority to build a bridge across the river, in the vicinity of Fort Washington Point on the New York side and Fort Lee on the New Jersey side. This is an ideal site for a single span bridge, as the ground on both sides of the river is high. On the New York side the land reaches a height of 200 ft. about 1,000 ft. from the shore, and on the New Jersey side it is 280 ft. high only 500 ft. inland. Fort Washington Point is a rocky cape where the rock descends steeply toward the centre of the river. On the opposite side of the river the rock is 115 ft. to 170 ft. below the surface, and similarly shelves steeply down toward the centre of the river; under water it is covered with soft mud and clay.



The George Washington Bridge across the Hudson River, New York, the longest suspension bridge in the world. In the foreground is one of the new vehicular traffic approach roads spanning a New York highway. We are indebted to The Port of New York Authority, for this photograph and the upper one on the opposite page, and for the information contained in this article.

Various types of bridge were considered, and finally it was decided that the structure should be of the suspension type. Plans were drawn up for a two-deck bridge, the upper deck to carry a roadway wide enough for eight lines of traffic, flanked by footwalks for pedestrians, and the lower deck to carry four electric railway tracks. As constructed, however, the bridge has only the upper deck, and the lower deck is to be added later.

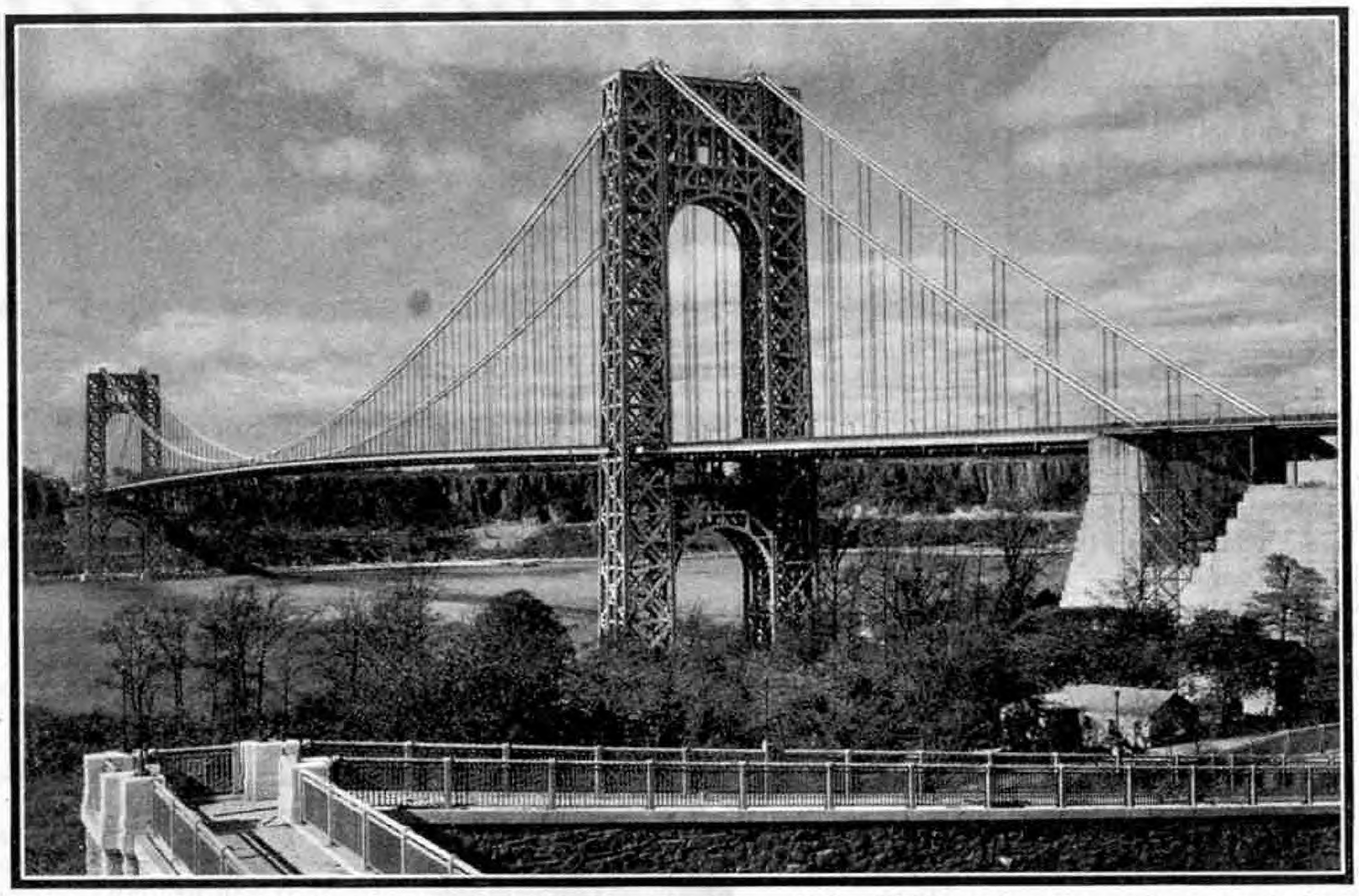
The George Washington Bridge, as this new structure is called, crosses the Hudson River in a single span 3,500 ft. long—the longest suspended span in the world, and just twice the length of the main span of the Delaware Suspension Bridge, Philadelphia, the previous record bridge of this type. The main span of the George Washington Bridge is suspended from four main cables that pass over towers at the ends of the span and are led down to and secured in anchorages behind the towers. The bridge has an overall length of 4,760 ft. and an overall width of 120 ft., and the towers carrying the main cables are 635 ft. high, above the river level. The upper deck is carried over the river at a height of 250 ft., and the lower deck when built will give a clearance of 213 ft. at the centre and 195 ft. at the New York tower. There are 73,000 tons of structural steelwork in the bridge, and 40,200 tons of this is accounted for by the towers.

Work was begun in May 1927 on the foundation for the New Jersey tower, and a year later on that for the New York tower. The foundation of the New Jersey tower is about 100 ft. out from the river bank, and that of the New York tower is at water level at the tip of Fort Washington Point. Open cofferdams were erected around the sites and the areas cleared of water. The

foundation of the New Jersey tower had to be built up to river level, and 37,500 cu. yds. of masonry were used for this purpose.

The towers of the George Washington Bridge differ from those of previous suspension bridges. Each consists of two massive legs, 106 ft. apart, made up of eight steel columns arranged two abreast and joined together by struts and heavy diagonal cross-bracing. The legs formed in this way are joined at the top and below the deck level by steel bracing curved to form an arch. The panels of the towers decrease in length towards the top, and range from 56 ft. 6½ in. at the bottom to 38 ft. 9½ in. at the top.

The steelwork for the towers was received and stored at New Jersey railway terminii several miles down the river from the bridge site. It was loaded as required on to railway trucks and conveyed to the quayside, where it was loaded on to barges and towed either to the New Jersey tower site or across the river to a specially-built wharf at the site of the New York tower. This wharf consisted of a series of stone-filled timber cribs that were moored to the tower foundation and to anchors firmly secured in the rocky bank to prevent the cribs from sliding down. A stiff-leg derrick on the wharf unloaded the steel from the car float and passed it to the tower derricks, and these placed it in position.



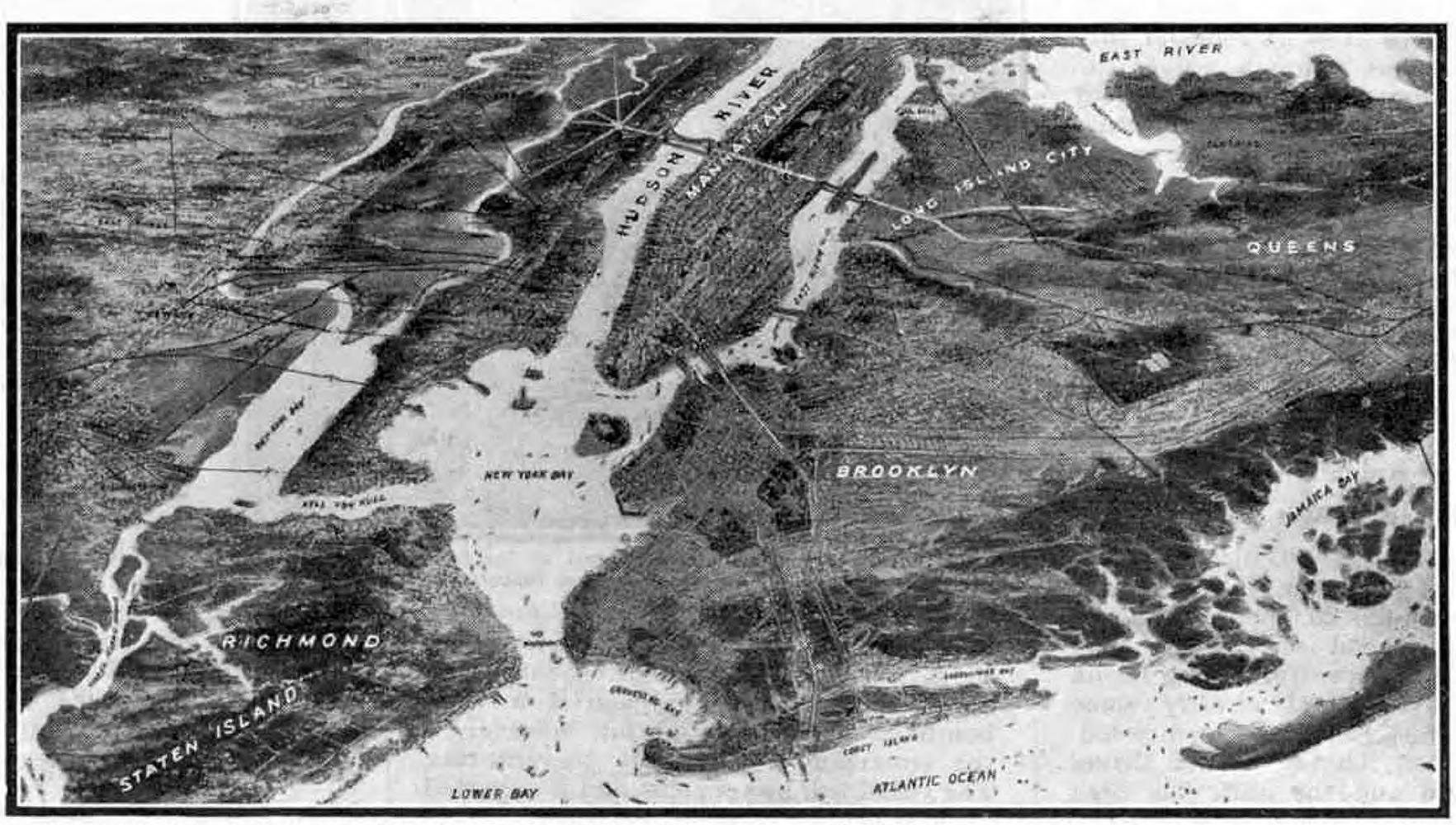
An impressive view of the bridge, from the New York side of the river. At the right the main cables can be seen extending into the massive concrete anchorage.

The bases or pedestals of the columns forming the legs of each tower are each 13 ft. 9 in. square and weigh 55 tons. The accurate setting of these pedestals was a delicate operation, but as soon as they were in place the erection of the columns went ahead rapidly. This work was carried out at each tower by means of two stiff-leg derricks with 85 ft. booms, mounted on a platform that bridged the gap between the inner rows of columns. The derricks worked independently, the only restriction being that maximum loads could not be handled by both at the same time. Each one was operated by a 300 h.p. seven-drum hoisting engine, situated on the ground near the tower. This arrangement prevented the engineer from seeing the bridge material as it was hoisted up into position, and instructions for operating the hoists were conveyed to him by means of red and white lights above the drums.

The steel sections of the columns ranged from 37 tons to 80 tons in weight and were hoisted into position complete with gussets and angle brackets for receiving the struts and diagonals. As each panel was assembled it was floored over with 4 in. planking to provide a working platform for the riveters, who followed the erection gangs panel by panel. The enormous number of 475,000 rivets, having a total weight of 325 tons, was used in each tower. The first steel was set in the New Jersey Tower on 25th June, 1928, and in the New York Tower six weeks later; and the towers were completed by the middle of June 1929.

While the erection of the towers was in progress the cable anchorages were constructed. The anchorage on the New York side is built above ground and is a huge mass of concrete weighing 370,000 tons. On the New Jersey side the land is higher, and the cable anchorage there is underground in the form of a sloping deep tunnel cut in the hard rock.

The next task was that of constructing the huge main cables from which the bridge deck is suspended. For this work two footbridges or working scaffolds were suspended, one on each side of the bridge and parallel with the positions to be occupied by the two groups of main cables. The footbridges were constructed in sections, and those used for the main span consisted of planking carried on steel beams. Steel ropes 2⅞ in. in diameter were raised to the top of the towers and secured there, and the footbridge sections were then hoisted up and rested on the ropes, enabling the workmen to walk from one bridge tower to the other. At various points along the main span trusses connected the two footbridges, so that the workmen could pass from one side of the bridge structure to the other.



Our illustration shows a bird's-eye view of the bridges of New York. The new bridge across the Hudson River is seen across the centre of the river towards the top.

The four main cables were erected in two pairs 106 ft. apart, the cables of each pair being 9 ft. apart from centre to centre. Each cable is about 3 ft. in diameter and

(Continued on page 317)



Engineering News of the Month

Hydrogen as Engine Fuel

An internal combustion engine capable of working on mixtures of hydrogen with oxygen or air, or on a mixture containing liquid fuel and air in addition to hydrogen, is undergoing trials in Germany. It is known as the "Erren" engine after its inventor, Mr. Rudolph Erren.

When a mixture of hydrogen and oxygen in correct proportions is employed in the new engine, combustion is complete and the exhaust is pure steam. When air is used instead of pure oxygen, or crude oil is introduced into the mixture, burning takes place more quickly and thoroughly than in ordinary internal combustion engines, the result being a considerable increase in efficiency.

There is no difficulty in obtaining the hydrogen required for the "Erren" engine, for the gas is one of the products of electrolysis of water. This process is now carried out on a commercial scale and the oxygen liberated is in demand for industrial purposes. Hydrogen for use in engines of the new type installed in road vehicles or locomotives may be stored under high pressure in cylinders that occupy little room. From these it is introduced into the engine cylinders through valves designed to prevent back-firing, a great danger with the highly explosive mixture formed by the gas and air. If the engine is to be run on a mixture containing only hydrogen and oxygen, a small portable electrolyser may be employed to produce the fuel. This liberates the gas in the exact proportions required to give the best results, and the mixture is passed directly into the cylinders.

A locomotive fitted with the "Erren" engine is being tried in service in Germany, and in this country road tests are being made of a lorry similarly equipped.

The Galloway Power Scheme

In connection with the Galloway Power Scheme a tunnel 11 ft. 6 in. in diameter is to be driven through 20,000 ft. of hillside in the neighbourhood of Glenlee, near Dalry. Tunnelling operations were begun in September 1932 and already some 8,000 ft. of tunnel have been completed. The first junction, linking up the drives from the portal and the adit, has been finished. The last section of rock between the two drives was removed by a shot electrically fired from the adit mouth.

The tunnel is being made to carry to the Glenlee power station water collected in a dam that is to be built at Clatteringshaws and which will have an area of about 1,000 acres. The Glenlee power station is one of five that are to be erected along the valleys of the Dee and the Ken.

A New French Battleship

Construction has now been commenced at Brest on a new 26,500-ton battleship for the French Navy. This vessel is to be named the "*Dunkerque*." It will be provided with two main turrets, each carrying four 330 m.m. guns, which are to be in the front of the vessel, arranged one rising behind the other. These, together with 16 guns of smaller calibre and 40 machine guns, are hoped to make the ship safe from attack in the air, for French naval officers think that no aeroplane could approach it to drop bombs. It is very doubtful, however, if the armament will actually prevent this. The vessel will be very fast and is expected to be ready for trials during 1936.



A steel ingot, 170 tons in weight, cast at the Grimesthorp works of Cramwell Lands & Co., to whom we are indebted for this photograph.

San Francisco Bridge Schemes

Work has now commenced on a bridge across the Golden Gate, the waterway that separates the narrow peninsula on which San Francisco stands, from the mainland to the north. The central span of this bridge will be 4,200 ft. in length, and thus will be the longest suspended span in the world. The supporting piers at the ends of the structure will be 740 ft. in height, which is almost as high as the Woolworth Building, New York. Beacons placed on the towers will serve as lighthouses for sea going vessels and for aircraft, and there will also be observation and lookout rooms in the towers, access to which will be gained by means of high speed lifts.

The deck of the bridge will be at a height sufficient to allow the "*Majestic*," the tallest liner in the world, to pass beneath. It will carry a 60 ft. roadway capable of accommodating six lines of traffic, and there will be two sidewalks for pedestrians.

Another bridge to be built at San Francisco will connect the city with Oakland, on the other side of the bay. It will be about seven miles in total length, more than 4½ miles of which will be over the waters of the bay. The bridge will be in two sections, the first of which will connect San Francisco with an island in the bay known as Goat Island, and this will cross a stretch of water some 9,000 ft. in width. It will consist of two great suspension spans, supported by a huge concrete pier midway between the island and the city. The deck level of the span will be 214 ft. above water. This section will be connected by means of a tunnel cutting through a hill on Goat Island, with the second section between Goat Island and Oakland on which there will be a cantilever span 1,400 ft. in length across the deep water channel; the remainder of the bridge is not expected to provide any difficult engineering problems as it will be constructed over land or shallow water.

When completed both sections of the bridge will have two decks, the upper one to carry six lines of motor car traffic and footwalks for passengers, and the lower one to take a double tramway track and a road for three lines of motor lorries.

Graving Dock with Unusual Gate

A new graving dock has been built at Elderslie for Barclay, Curle & Co. Ltd., by Sir Robert McAlpine & Sons. The dock is 620 ft. in length, 85 ft. in width at the entrance and 36 ft. in depth from sill to cope level. A particularly interesting feature of the design of the dock is a special gate of the single lift type with the hinge or keel running horizontally across the sill instead of, as usual, vertically to it.

The World's Land Speed Record

For the sixth time in eight years, Sir Malcolm Campbell has succeeded in setting up a new world's land speed record. His latest attempt was made at Daytona Beach, Florida, where he attained an average speed of 272.108 m.p.h. during two runs over the measured mile. This is nearly 19 miles an hour faster than the record he made at Daytona Beach last year, and means that he covered a mile in 13.23 seconds.

Sir Malcolm also set up new figures for the kilometre and five kilometres. His average time for two runs over the kilometre was 271.636 m.p.h., the previous record being 251.340 m.p.h. The new five kilometres speed record is 257.295 m.p.h.

The successful attempt on the records was made under very trying conditions. The beach was rough and at the end of the attempt the tyres were badly cut, while Sir Malcolm was forced to drive with one hand as he had sprained his arm a few days before the attempt. During the run the car crashed into two of the posts set to mark the course.

The car in which Sir Malcolm broke the record was the "*Blue Bird*," a car that is entirely British. It is driven by a Rolls-Royce S.6B Schneider seaplane engine that develops 2,500 h.p. This is 1,000 h.p. more than the Napier engine that Sir Malcolm used last year.

World's Largest Gear Wheel

On page 757 of our issue for October 1932, we gave a description of what is claimed to be the largest gear wheel in the world. A photograph of this gear wheel, constructed by Engrenages Citroën, of Paris, appears on this page. The wheel is 48 ft. in height, and is about 17 ft. 6 in. in diameter and 2 ft. 6 in. in overall width. It has 152 teeth, the faces of which are 2 ft. 1 in. in width, and the pitch is 4.4 in. The small gear wheel with which it meshes has 24 teeth and its speed is 190 r.p.m., while that of the larger one is 30 r.p.m. The wheel will normally transmit power up to 2,000 h.p., but this may safely be increased to 4,000 h.p. for short intervals.

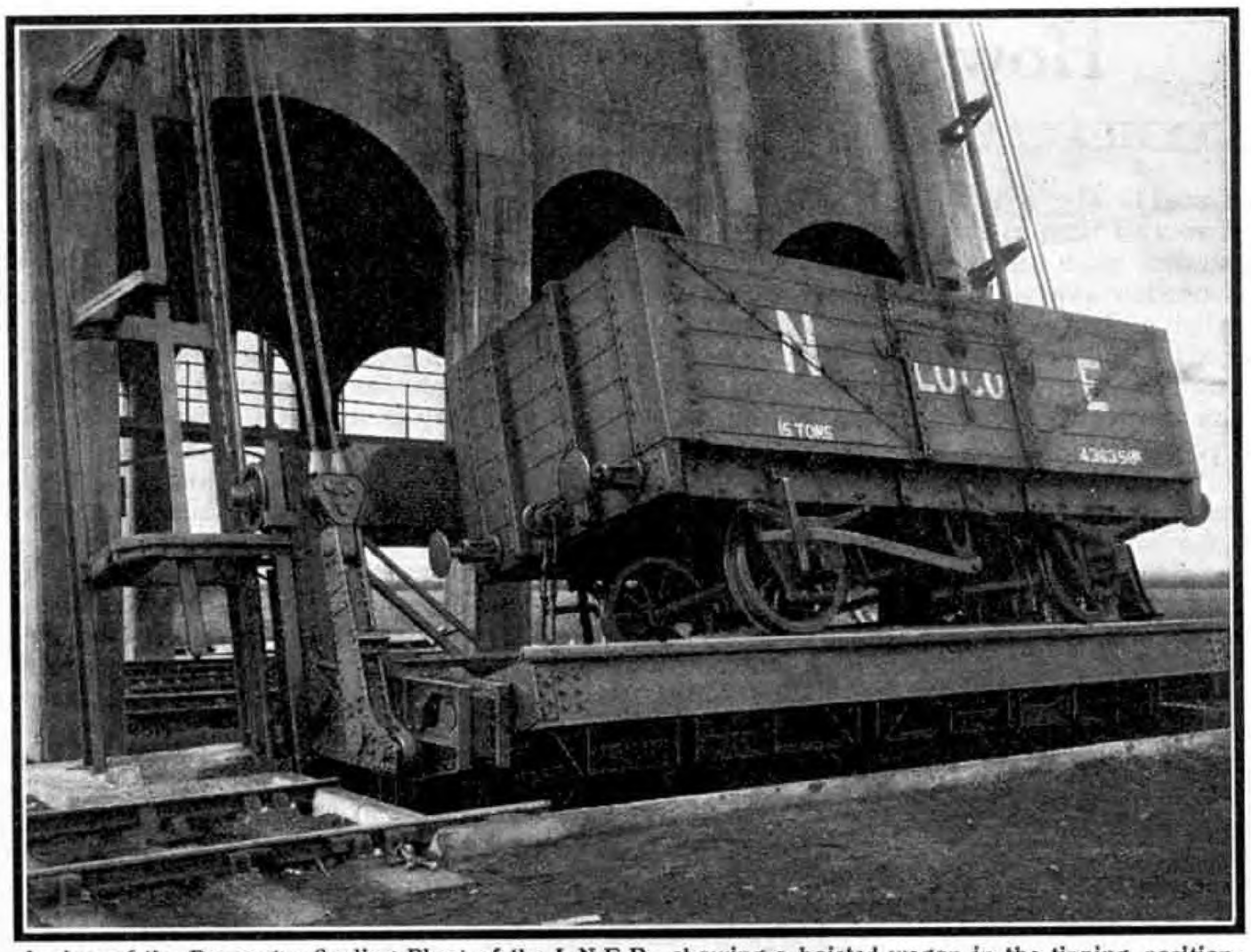
Mobile Petrol Tank to Hold 2,500 Gallons

A mobile petrol tank capable of holding 2,500 gallons of fuel, has been constructed for the Anglo American Oil Co. Ltd. The tank, which is of welded construction, is mounted on a Leyland six-wheeled chassis and is provided with five separate compartments. The barrel is elliptical in cross section, and is 28 ft. 8 in. in overall length.

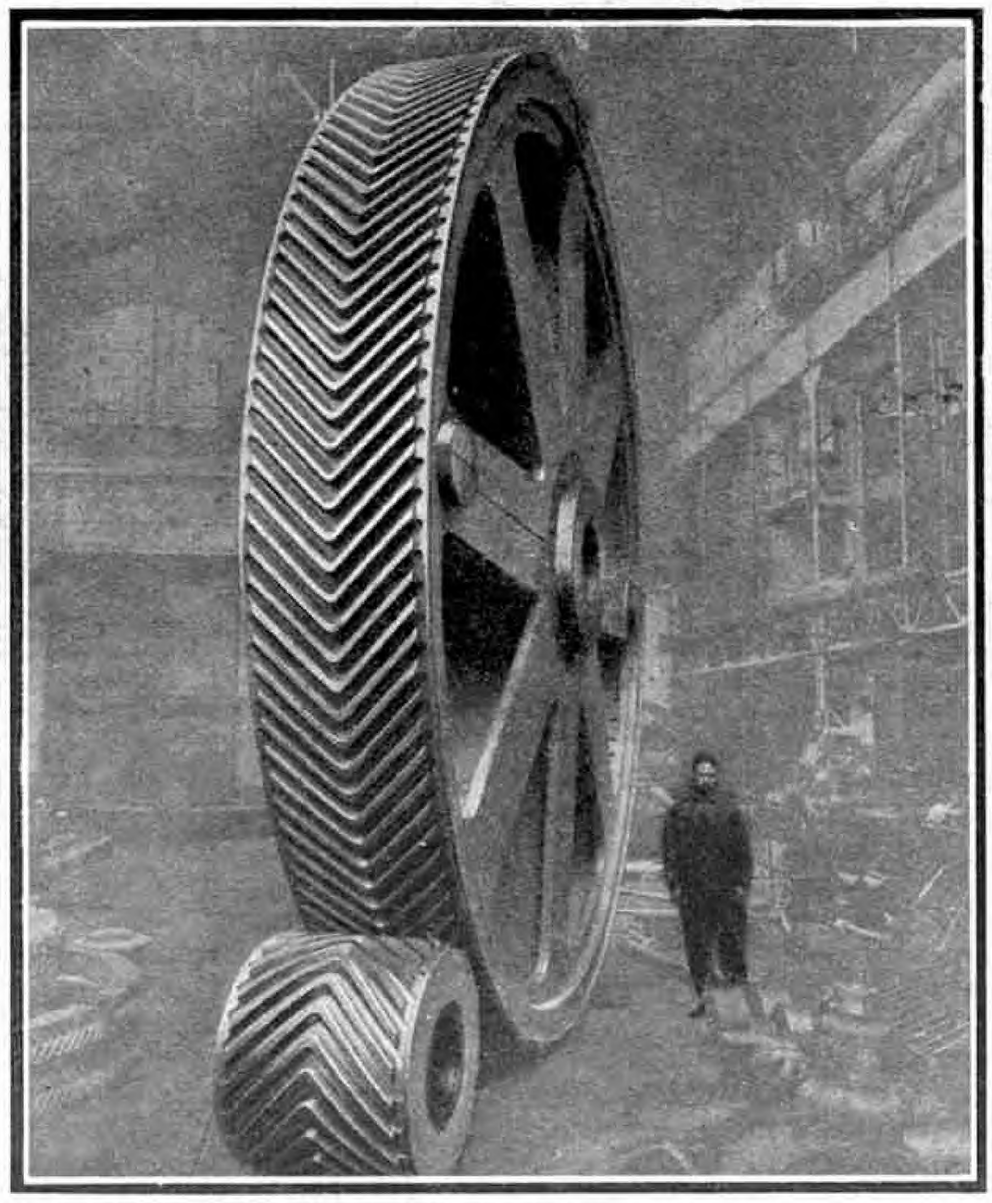
Each of the compartments has a man-hole 1 ft. 4 in. in internal diameter provided with a specially designed aluminium lead. Any of the five compartments can be emptied of the 500 gallons of petrol it holds in only seven minutes.

The engine with which the chassis is equipped is a six-cylinder unit with a bore and stroke of $4\frac{9}{16}$ in. and $5\frac{1}{2}$ in. respectively. It has a designed output of 72.7 b.h.p. when operating at 1,000 r.p.m. and is capable of driving the tank at speeds varying between 2.5 and 14 m.p.h.

A normal-sized tank wagon usually holds between 1,000 and 1,500 tons of petrol.



A view of the Doncaster Coaling Plant of the L.N.E.R., showing a hoisted wagon in the tipping position. For our photograph we are indebted to the Mitchell Conveyor & Transporter Co. Ltd., London.



A description of this, the world's largest gear wheel, appears on this page. Photograph by courtesy of Engrenages Citroën, Paris.

New Hudson River Bridge Opened

A new bridge across the Hudson River, between Albany and Rensselaer, N.Y., has been opened. It is believed that this bridge, which is of the vertical lift type, has the heaviest movable span of its kind in the world. This span is 341 ft. long and weighs 2,700 tons. It is raised and lowered by two 250 h.p., 410 r.p.m shunt-wound motors, either of which is capable of performing the task alone. The electrical equipment for the bridge was designed and built by the General Electric Company of New York.

Control for the bridge is located in a switch-house mounted above the centre of the movable span, where the operator has an unobstructed view of both bridge and river. As a safety precaution, the entire system is interlocked so that the span cannot be raised until the gates at both ends are in position and the traffic signals for motorists have automatically turned red. When the span reaches the top of the towers, a signal to proceed is flashed to boats on the river. With the span raised to its maximum height, river craft have a clearance of 135 ft.

Dismantling a Large Cofferdam

One of the largest cofferdams ever built is now being removed at West St. John, New Brunswick. The cofferdam was erected in 1928 to keep back the waters of the Bay of Fundy in order to permit dry excavation and concrete construction to be carried out on harbour extension work and the building of a new pier. The pier is 700 ft. in length and is constructed entirely of concrete.

More than 120 men are engaged in the work of dismantling the dam, which is expected to occupy between five and six months. During this time 500,000 c. yd. of stone and clay will be removed by dredging, in addition to some 2,000 c. yd. by draglines. About 4,000,000 lb. of sheet piling was used in the dam and this was dovetailed together and sunk, in some cases to depths of 90 ft. The cofferdam has a perimeter of 5,890 ft. and encloses an area of more than 43 acres.

Aerial Mast 878 ft. in Height

A radio transmitting station at Nashville, Tennessee, is equipped with a "mast," or tower for supporting the aerial, that is 878 ft. in height. The tower, which is square in section, is $2\frac{1}{2}$ ft. square at the base, but at the level where the supporting guys are attached it is 38 ft. square. Above this it tapers, and is 3 ft. square at a height of 758 ft., where a tubular pole 120 ft. in length is attached. The tower has been designed so that it is capable of withstanding wind pressures up to 30 lb. per sq. in.

High-Speed Electric Coaling Plants

How a Locomotive is Fuelled

FIFTEEN million tons of coal! The average boy who is used only to seeing a ton or two at a time in the domestic coalhouse will find it hard to visualize such an enormous amount, yet this is the quantity that is needed every year to fuel the 23,000 locomotives running on English railways. An express locomotive uses about two tons for each 100 miles of travel!

The coaling of railway engines involves a tremendous amount of work, and until a few years ago it was nearly all done by manual labour. Coaling by man power alone was so slow, however, that at busy points of a railway system it was no unusual occurrence for locomotives to be held up for hours waiting their turn for coal. In order to avoid this waste of valuable earning time engineers set to work to devise some mechanical means of coaling, and after much experiment satisfactory coaling plants have been produced.

The first mechanical coalers were erected shortly before the Great War, and although they had many defects they were a great advance on the old method of coaling by hand. Since then many others have been built and installed at important coaling stations, and in these considerable improvements have been made. Some of the finest plants now at work can easily coal from 100 to 150 engines per day, and need only one man to operate them.

The coaling equipments shown in the accompanying illustrations have been designed and supplied by the Mitchell Conveyor & Transporter Company Ltd., of London, one of the pioneer firms in this branch of engineering. The broad principle of the Mitchell plants is to elevate a complete truck of coal, to tip the coal into an overhead bunker, and then to draw it off from below as required by the locomotives.

Some of the earliest coaling plants designed and installed by the Mitchell Company consisted chiefly of gravity-bucket conveyors taking coal to overhead bunkers, from which it was fed through weighing machines to the locomotive tenders. Another plant designed by this company consisted of a belt conveyor to lift the coal, instead of the gravity bucket conveyor. Gradually these types were replaced by an improved form of coaler, a good example of which is erected at Willesden on the L.M.S. Railway system. This plant consists of a rotary tippler, a feed-tippler and a skip-hoist feeding into a 5-ton overhead hopper. The hopper is large enough to accommodate a full load for the biggest locomotive tender coaled at this station. The tippler is operated by "tramway" type electric controllers, but the skip-hoist and feeder plate are under automatic control arranged so that directly the current is switched on, the feeder-plate delivers coal to the skip. The feeder continues to run until one ton of coal has been fed to the skip. It then stops automatically, and the skip rises and discharges to the overhead bunker, after which it returns automatically for another load. These operations continue until stopped by the operator, and this plant is capable of loading coal at the rate of about 40 tons per hour.

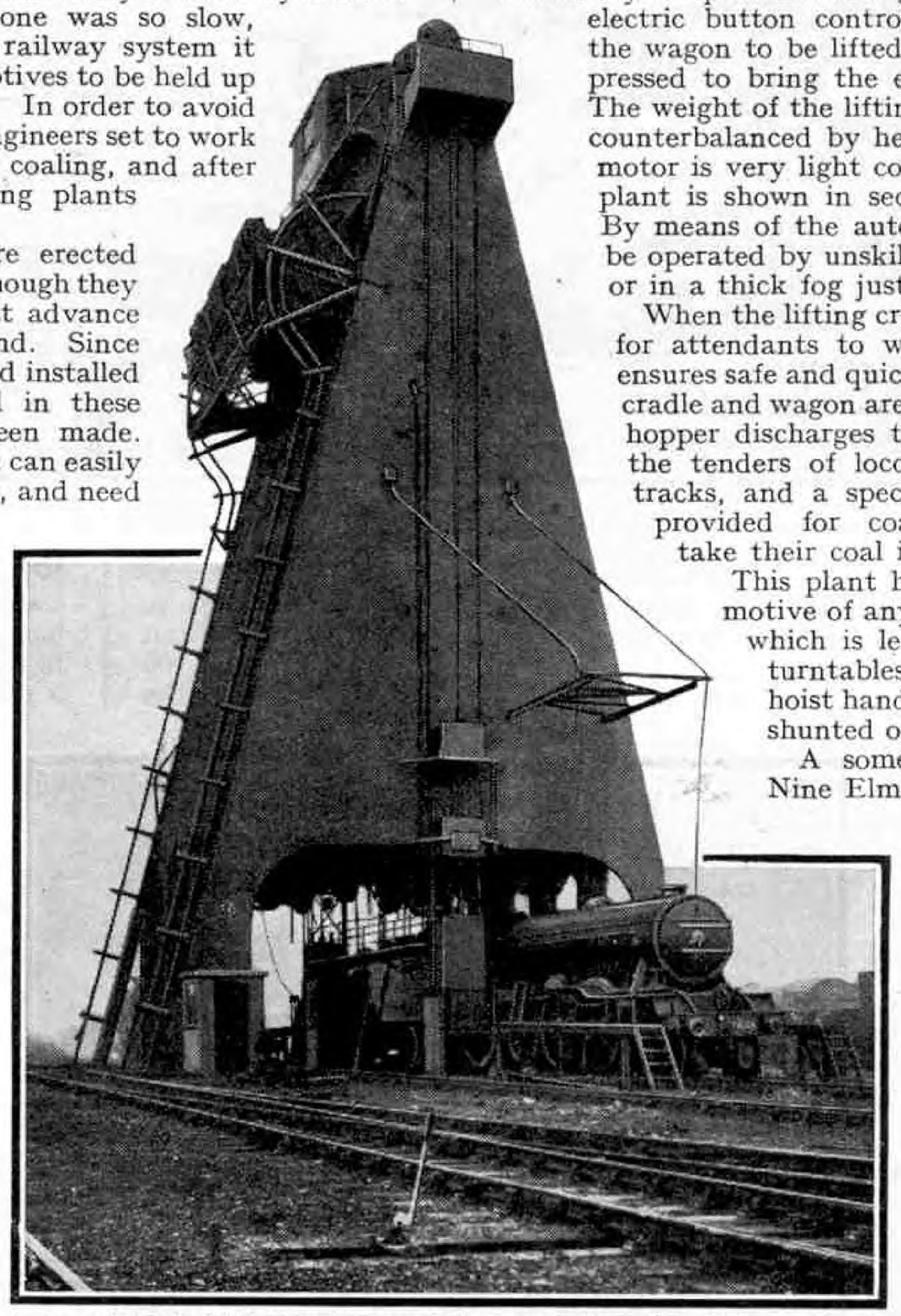
Although this form of coaler is a great advance on the earlier belt conveyor type, it still has various disadvantages, one of which is that it involves the use of three electric motors, the failure of any of which might put the plant completely out of action. As it is essential that a coaling plant must never stop once it has taken over the coaling of a yard, this consideration led to the introduction of an entirely new type of plant, in designing which the chief aim was to reduce the number of working parts to a minimum.

The first of these installations was set up at Crewe for the L.M.S. Railway. The plant consists of a single compartment bunker of 200 tons capacity, and a wagon hoist tippler that elevates any size of wagon and discharges it direct into the bunkers, requiring one winch and one motor only for its entire operation. The machinery is operated from ground level by means of a series of electric button controls. Pressure on one button causes the wagon to be lifted and tipped, and a second button is pressed to bring the empty wagon back to railway level. The weight of the lifting cradle, wagon, and half the coal is counterbalanced by heavy weights so that the load on the motor is very light compared with the load hoisted. This plant is shown in section in the accompanying diagram. By means of the automatic button control the plant can be operated by unskilled labour, and can be used at night or in a thick fog just as easily as on a clear day.

When the lifting cradle is down, there is a free flush deck for attendants to walk on without interruption, which ensures safe and quick handling of the wagons. When the cradle and wagon are raised only a shallow pit is left. The hopper discharges through half-ton measuring boxes to the tenders of locomotives standing on either of two tracks, and a special feeding chute and valve is also provided for coaling local shunting engines that take their coal inside the cab.

This plant has proved so successful that a locomotive of any size can be coaled in three minutes, which is less than the time taken to turn the turntables, or to pass over the points. The hoist handles 12 wagons per hour, and these are shunted on and off the cradle by a locomotive.

A somewhat similar plant is installed at Nine Elms on the Southern Railway. In this case it is necessary to deliver two classes of coal through adjacent chutes in such a manner that a locomotive can be coaled without moving. In operation the coal trucks are run, one at a time, on to a cradle lying at rail level in a pit at the bottom of an inclined elevator. They are roughly positioned in the centre of the cradle and are then pinned down by brakes. No other fastening is necessary, for when the cradle is resting in the pit it naturally lies horizontally, so that the trucks may be run on to it off the siding. As soon as the winding drum is started, however, the cradle is tilted over gently towards the elevator. The truck then cants over and is caught by a wooden buffer beam. In this position a large part of the weight is carried by the buffer beam so that, owing to friction, there is no chance of the truck moving as it is hoisted up.



A general view of the Doncaster coaling plant of the L.N.E. Railway, showing a loaded wagon on the cradle during hoisting. Photograph reproduced by courtesy of the Mitchell Conveyor & Transporter Co. Ltd., London.

The tipping action is obtained in the following manner. The cradle has at each end an approximately L-shaped frame, with the vertical leg lying on the elevator guides, and the horizontal leg underneath the track. Between the horizontal end legs there is pivoted a secondary frame for carrying the railway metals, and the pivot is arranged outside the centre of the track. When the cradle is in the bottom position the secondary frame rests on stops built up from the ground, so that the metals must register with those of the siding. When hoisting is started the frame leaves these stops, and the truck, being out of balance, must tip over against the buffer beam.

At Nine Elms the hoisting is effected by a double purchase, with a rope at each end of the cradle. The ropes are anchored at the top of the hoist, pass down behind and underneath the cradle, over guide sheaves, and then up to a hoisting winch, which is arranged in a housing at the extreme top of the structure. In this manner an

even lift is given to the two sides of the cradle, so that there is little stress on the guides; and there is room between the two falls of the rope for the passage of the truck.

On each of the vertical legs of the cradle there are two guide wheels, one above the other, which run on separate guide rails secured to the inclined elevator structure. Near the top of the structure the guide for the lower wheel is bent outward, and so causes the cradle to tilt towards the hoist. The upper guide wheels meanwhile run into cup-shaped recesses, which make them act as pivots about which the cradle turns. As the winding proceeds the angle of tilt increases, and eventually the coal in the truck begins to fall out into the adjacent hopper. At the same time the top of the truck comes into contact with a "sustaining beam," which is a longitudinal girder that follows the truck through the tipping action and prevents it from falling from the cradle into the hopper. This beam or girder is supported on radial arms from the centre of rotation, and is held in check by wire ropes and balance weights sufficiently heavy for the largest truck. Thus it will be seen that, throughout hoisting and tipping, the truck is gripped entirely automatically and in a very simple manner. To return the truck to ground level after its contents have been tipped, the hoist is simply reversed, and the sustaining beam pulls the truck back until it is in a position to run down by gravity.

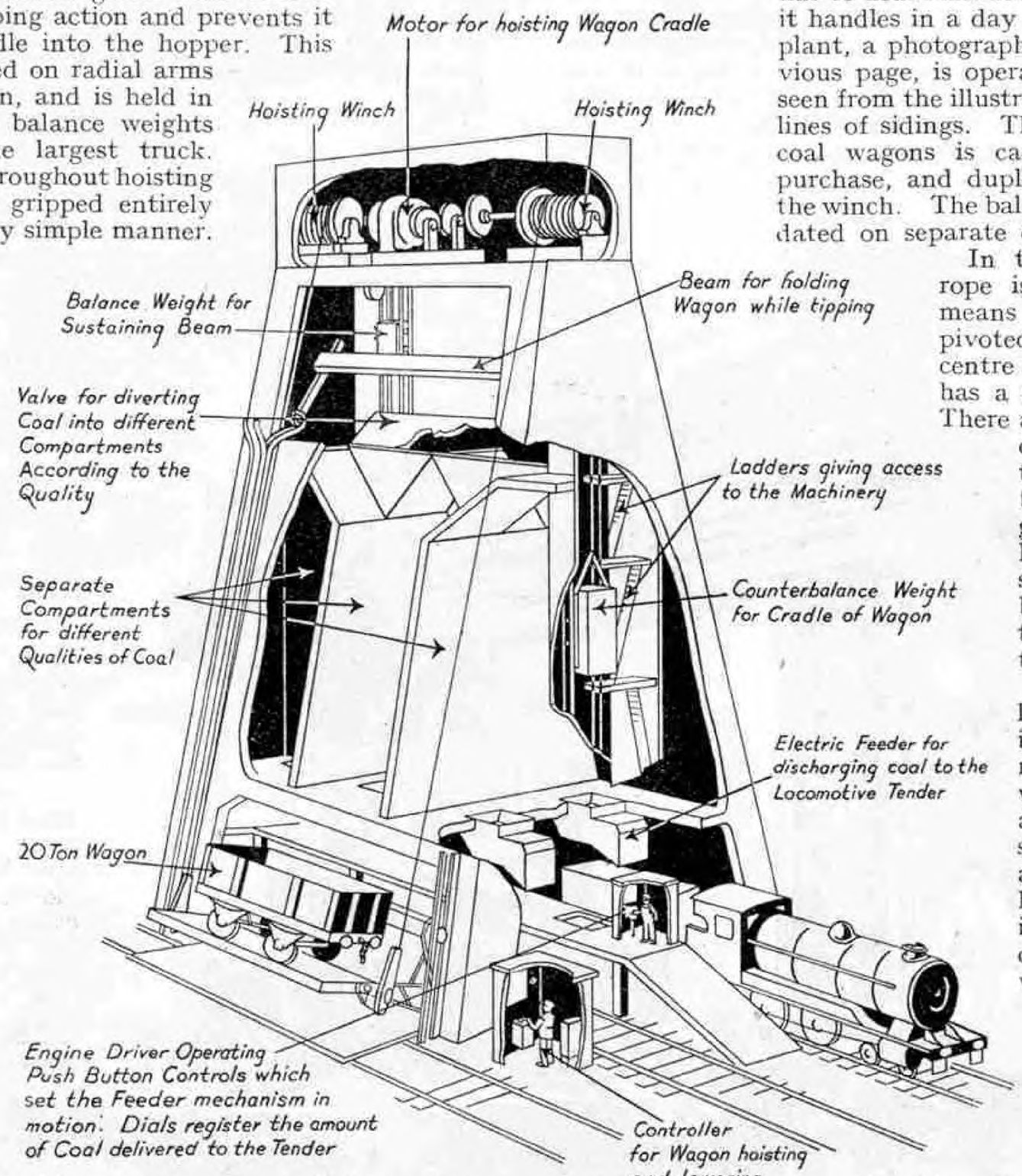
In order to reduce the load on the motor during hoisting, part of the weight of the cradle and truck is counter-balanced by heavy weights running down inclined tracks. At the bottom the tracks curve outward to a more or less horizontal direction, so that the balancing effect of the weights is reduced as the truck is tipped. The counter-weight ropes are wound on the same drums as the hoisting ropes, but in the opposite direction; and with the help of a purchase the length of travel of the weights is made to correspond with that of the cradle.

The hoisting winch itself needs little description, as it is a simple machine driven through machine-cut gears by a 30 h.p. motor. The control cabin is on the ground level, but there is a limit switch, geared with the winch drum, to cut off the current to the motor at both ends of the operation.

The hopper is constructed of reinforced concrete and is capable of holding 400 tons of coal. It is divided into two compartments, and at the inlet there is a depending flap valve that can be moved to one side or the other, so that the incoming coal can be diverted to either side. These flaps also permit two qualities of coal to be stored separately. There are eight discharge chutes fitted with double doors. The intervening space between the doors has a capacity of 10 cwt., and thus keeps a check on the consumption of coal.

A modified form of this plant fitted with a special device to prevent breakage of the coal when it is tipped from the wagon into the bunker is also installed on the L.N.E.Rly., at York. The anti-breakage device consists essentially of a 20-ton capacity container that receives coal from the wagon and lowers it into the bunker. The method of operation is as follows. As the wagon is caused to tip on its side when it reaches the top of the hoist, the top of the wagon comes in contact with the sustaining beam already mentioned and causes the beam to rotate. The continued movement of the beam brings in contact with the top of the container a steel roller mounted on the back of the sustaining beam framework. Further movement of the sustaining beam forces the container to move downward in its guides and gradually to resume an upright position as the coal is transferred from the wagon. Suitable balance weights are arranged on the container winch drum to counter-balance the weight of the container itself, and a portion of the coal discharged from the wagon. As the coal is tipped from the wagon to the container it gradually overcomes the balance weights and causes the container to descend under the control of a centrifugal friction brake. The container continues to descend until a grid attached to levers operating the container discharge doors comes in contact with the coal already in the bunker, or bottom of the bunker. The doors then open instantaneously and the coal is discharged, thus allowing the balance weights to reassert themselves and return the container to its position ready to receive a new charge of coal.

One of the most hardly-worked coaling plants at present operating in this country is that at Doncaster on the L.N.E.R. Normally it has to deal with 150 engines a day, but sometimes it handles in a day as many as 190 engines. The plant, a photograph of which appears on the previous page, is operated by one man. As will be seen from the illustration, the hopper straddles two lines of sidings. The hoisting and tipping of the coal wagons is carried out on the single-rope purchase, and duplicate motors are provided for the winch. The balance weight ropes are accommodated on separate drums.



In this type of plant, the hoist rope is attached to the cradle by means of a heavy lever that is pivoted to the cradle at about its centre of gravity, and at its long end has a shackle for the hoisting rope. There are two ropes, one for each end of the cradle. The long end of the lever is of such a dimension that when the cradle is on the ground its span is greater than half the width of the coal truck, so that the hoisting rope is held back beyond the side of the truck, thus allowing free entry to the cradle.

In order to ensure that the lever does take up this position, its short end is provided with a roller that comes into contact with a fixed slide on the ground as the cradle settles on to its seating. The result of this arrangement is that when hoisting is started the lever is gradually brought into a more or less vertical position in line with the lead of the rope, and as the roller on its short end moves on a fixed track it gently starts the cradle into motion. During this process the truck dips over against the bolster as already described in connection with the Nine Elms plant. The hoisting then continues just as if the rope were attached directly at the centre of the cradle.

No rope pulleys of any description are employed, and the cradle hoisting rope passes direct from the winding drum to the cradle, and the balance weight ropes direct from the winding drum to the weights. The rope drums are 4 ft. 6 in. in diameter. Two suspension ropes are provided, and each is strong enough to take the full load if the other should break. There are also two entirely separately operated braking devices, which are arranged to hold the load in the event of a mishap to the gearing, such as the motor shaft breaking.

Encouraged by the successful performance of their earlier coaling plants, the Mitchell Conveyor and Transporter Co. Ltd. are continuing their endeavours to make the coaling of locomotives even more accurate and inexpensive. In their most recently-designed coaling plant the locomotive driver himself draws off the coal he requires, without the help of any attendant to operate the plant. The method of working is simple, for all he has to do is to record his engine number and press a button marked "Start." This button controls the mechanism of the feeder plates of the bunker, and when enough coal has been loaded into the tender the engine driver presses a second button marked "Stop." An ingenious machine records the amount and kind of coal placed in the tender. Such an installation is a very great advance upon the old method of shovelling the coal from the wagons into tubs, or skips, which are then discharged into the tenders by a crane.

Modern Planing Machines

Cutting Speeds of 300 ft. Per Minute

ONE of the most useful and convenient machine tools used in constructional engineering is the planing machine, the purpose of which is to produce a true flat surface in metal. It does this by means of the strokes of a cutting tool, which removes surplus metal as the work slides backward and forward in the bed of the machine, the tool itself being moved to one side after each stroke in order to cover the whole of the surface to be planed.

Before the invention of the planing machine, flat surfaces in metal could be produced only by the costly and laborious process of hand-chipping and filing. To-day the machine has been developed to such an extent that surfaces up to 16 ft. in width may be planed at speeds as high as 300 ft. per minute, and at a far smaller cost than was the case in the days when machinery was not available. Even in 1856, when planing machines were much smaller and slower in action than those in use to-day, a square foot of surface could be made true for less than a penny; whereas in 1826 the cost of hand-chipping and filing was as high as 12/- per sq. ft.

The first of the planing machines that brought about this revolution in the engineering industry seems to have been that of Joseph Clement. Others were at work on similar machines, but the credit of being the inventor is usually given to Clement, who in 1820, or even earlier, regularly used a machine designed by himself for planing the bars of lathes and the sides of looms. In 1825 Clement completed a second machine. This was more elaborate than the first and was remarkably accurate, the rollers being so true that Clement once remarked: "If you were to put but a paper shaving under one of them, it would at once stop all the rest." For 10 years after its erection this machine was the only one on which large work could be planed, and often it was kept at work night and day.

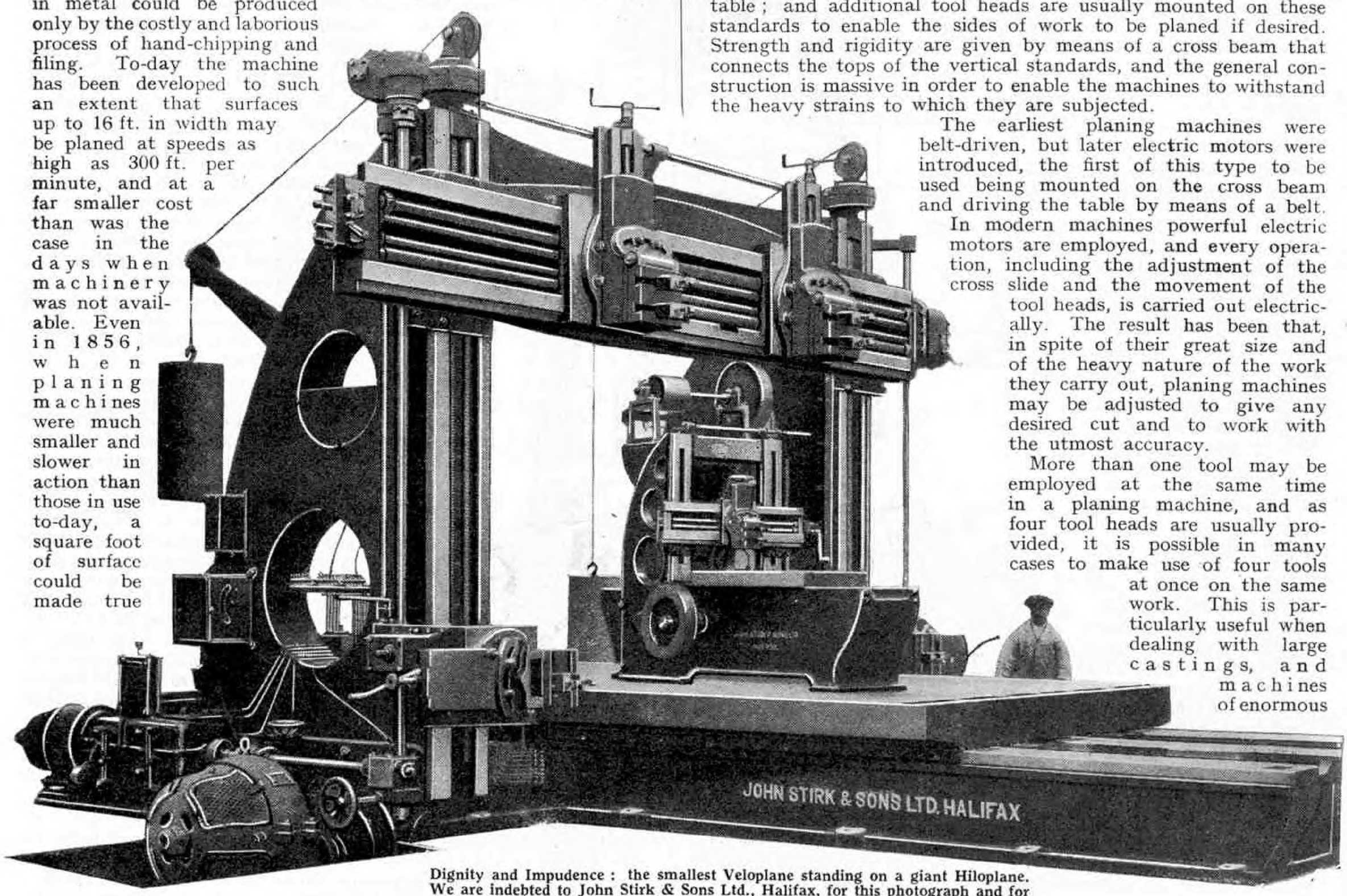
During last century planing machines became familiar features of engineering workshops. In general appearance those in use to-day resemble the earlier machines, but every detail of the mechanism has been made more efficient and the sizes of the machines employed have been greatly increased. The sliding table on which the work is carried was at first moved by the direct pull of a heavy chain coiled round a drum. Later machines had tables driven by means of a screw, but rack gear is employed on modern machines. The tables now used are of the double plate type and run accurately backward and forward on V-shaped guides.

The cutting tools are carried in heads moving on a cross slide supported on two vertical standards, one on each side of the table; and additional tool heads are usually mounted on these standards to enable the sides of work to be planed if desired. Strength and rigidity are given by means of a cross beam that connects the tops of the vertical standards, and the general construction is massive in order to enable the machines to withstand the heavy strains to which they are subjected.

The earliest planing machines were belt-driven, but later electric motors were introduced, the first of this type to be used being mounted on the cross beam and driving the table by means of a belt.

In modern machines powerful electric motors are employed, and every operation, including the adjustment of the cross slide and the movement of the tool heads, is carried out electrically. The result has been that, in spite of their great size and of the heavy nature of the work they carry out, planing machines may be adjusted to give any desired cut and to work with the utmost accuracy.

More than one tool may be employed at the same time in a planing machine, and as four tool heads are usually provided, it is possible in many cases to make use of four tools at once on the same work. This is particularly useful when dealing with large castings, and machines of enormous size have been constructed in order to plane the surfaces of massive objects, such as turbine casings, castings for marine engines, and the cylinder blocks of locomotives.



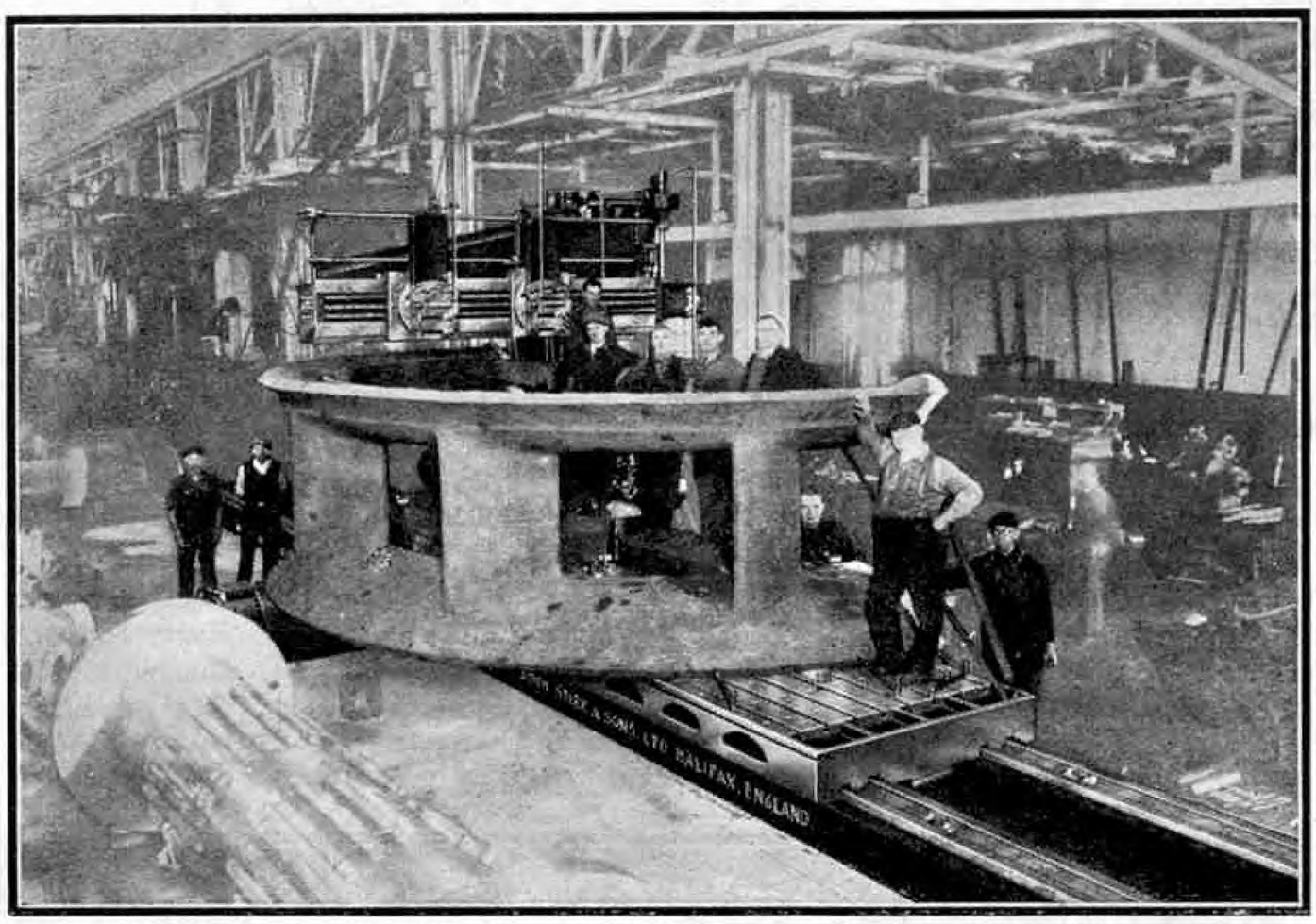
Dignity and Impudence: the smallest Veloplane standing on a giant Hiloplane. We are indebted to John Stirk & Sons Ltd., Halifax, for this photograph and for the illustrations on the opposite page.

An excellent example of a large planing machine of the type we have described is the "Hiloplane," made by John Stirk & Sons Ltd., of Halifax. As the name of this machine indicates, it is intended for work at high and low speeds, the large variation possible enabling a wide range of work to be dealt with.

Hiloplanes may be designed to deal with any desired size of work, but normally they are made in 12 sizes, their widths varying from 5 ft. to 14 ft. The movements of the tool heads are controlled by means of a pendant switch the employment of which gives the operator instantaneous control over their actions, and keyless steel driving gears are employed throughout. Machines 5 ft. in width between the standards are fitted with helical driving gears and rack, the gears being cut accurately from solid forgings and provided with splash lubrication. Larger planers from 5 ft. to 9 ft. in width are driven by means of patent forged steel driving gears, and the tables of still larger sizes are provided with twin racks.

If required, a special spiral drive may be provided for the tables of machines of all sizes. Whatever the system of drive employed, the keyless principle is maintained throughout, no keys being employed in the driving train after the motor pinion or coupling, a practice that has enabled the remarkably high cutting speed of 300 ft. per minute to be attained without difficulty.

The table of a Hiloplane is driven by an electric motor coupled directly to the machine gearing, this motor being supplied with current from a special generator that itself is driven by means of a primary motor working from either D.C. or A.C. mains. The special generator is employed for the purpose of giving accurate and reliable means of reversing the direction of travel of the table and of varying its speed. Its magnetic field may be manipulated to give current of varying voltage, thus enabling different working speeds to be employed; and also to change the polarity, the effect of this being to reverse the direction of rotation of the motor, and with it that of the movement of the table.



An open-side Hiloplane in a Canadian factory, set to work on a turbine ring section. This machine has a stroke of 26 ft. and can deal with work 7 ft. 8 in. in width and 6 ft. in height.

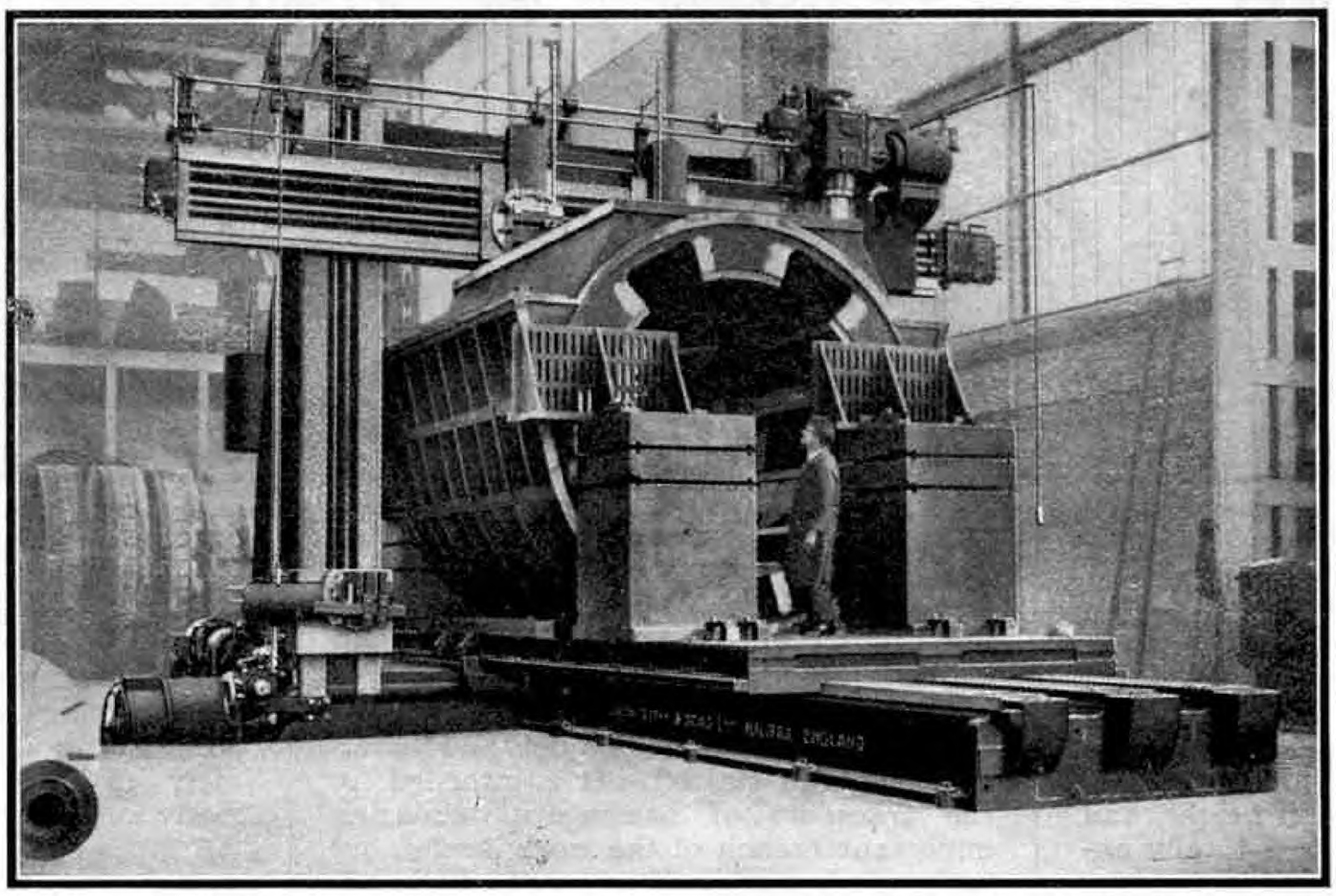
The system employed for this purpose on the Hiloplane is known as the Stirk patent split field drive, and depends on the division into two sections of the shunt field windings of both the generator and the motor driven by it. In the generator the two sections are so connected that they oppose each other, thus giving the alternating polarity required to bring about reversal. The action of reversal is entirely automatic, and a patent device prevents shock when the direction of travel of the table is changed while high-speed work is in progress. The two sections of the motor field are connected to agree, and one is permanently excited. The second section is only excited during the cutting stroke, and the system gives a slow cutting speed and a more rapid return speed, both of which may be varied as required by means of shunt regulators.

After each cut, the tool making it has to be moved sideways in order to remove the next strip of unwanted material, and this feed action, as it is called, must take place with great accuracy. Small electric motors are employed for this purpose, and their action is practically instantaneous, the feed being accomplished in from half to a full turn of the motor concerned. Demonstrations with the Hiloplane have shown that feeds of various widths are completed while the table beneath the tool travels about $\frac{1}{2}$ in. For ordinary planing work the range of feed varies from 1/32 in. to 1 in. on small machines, and to 2 in. on larger machines; but special Hiloplanes have been built that have a feed of 6 in., and there would be no difficulty in adapting the standard mechanism to give a greater movement if necessary. The toolheads on the cross slide may be made to move towards or away from each other, or to feed in the same direction, each being independently controlled.

The Hiloplane is controlled with remarkable ease by means of a pendant switch swivelled at the end of a tubular arm in order to enable the operator to swing it round to any desired point. Push buttons projecting through the body of the switch enable the machine to be started or stopped and give easy control over all necessary movements, including "inching," or making slight adjustments when setting work and tools.

Ordinary planing machines have two vertical standards or pillars carrying the cross slide, but in order to enable larger work to be dealt with machines with an open side have been introduced, a single column serving as support for the cross slide. One of our illustrations shows a Hiloplane of this type at work on a turbine ring section in a Canadian factory, and the photograph reproduced gives a vivid idea of the size of the machine. The planer shown is capable of dealing with work 26 ft. in length, 7 ft. 8 in. in width and 6 ft. in height. The illustration shows the toolheads of the cross slide, which are used for flat work; but those carried by the massive standard, and hidden by the work itself, perform the actual cutting on this particular job.

Successive machines of this type have shown remarkable increases in size, and an open-side Hiloplane recently completed has a reach of no less than 10 ft. 6 in. from its single column. A further development of the open-side Hiloplane is the machine with an independent side standard that, when desired, may act as a second support to the cross slide as in ordinary planing machines, or may be moved away in order to convert the planer into an open-side machine.



A Hiloplane with planing and milling heads in a Belgian engineering works. It is capable of taking work 26 ft. in length, 12 ft. in height, and 12 ft. in width. Comparison with the figure of the workman gives a vivid idea of the size of this giant Hiloplane, on which a large stator is being machined.

One of the illustrations to this article shows a small planer mounted on the table of a Hiloplane. The smaller of the two machines is a Veloplane, a type also manufactured by John Stirk & Sons Ltd. This machine is made in 14 sizes, ranging in width from 2 ft. to 7 ft., and incorporates the characteristics of the larger planing machines manufactured by the firm.

Both Veloplanes and the giant Hiloplanes are built with great accuracy, and when assembling the machine the alignment of parts is subject to the most rigid tests. A special instrument developed by the firm is employed for aligning planer beds. This is known as the "micrometscope," a combination of microscope and micrometer as its name implies; and it is capable of detecting small errors in adjustment and ensuring their correction. Both Hiloplanes and Veloplanes are built within very close commercial limits of accuracy, and a special Veloplane for use at the National Physical Laboratory, London, was actually made to limits of one ten-thousandth of an inch per foot. The accuracy of stroke of a Hiloplane was proved during the Engineering Exhibition of 1920 at Olympia, when a machine close to a pillar was made to crack nuts placed between the pillar itself and the end of the table.



Britain Gains Long-Distance Record

An interesting feature of the Fairey Long Range Monoplane in which Squadron Leader Gayford and Flt. Lt. Nicholetts set up a new world's long-distance record is that it was designed some five years ago, while the type of engine used was first produced about 15 years ago. This is a practical proof of the superiority of the British aero engine and aeroplane, and if a new machine were to be designed embodying all the knowledge that has been obtained from the present Fairey Long Range Monoplane, it is certain that the record could be considerably exceeded.

Readers of the "*M.M.*" will remember that the record was made in February of this year by a flight from Cranwell to Walvis Bay in South Africa. Actually a distance of 5,411 miles was covered at a speed of 93.46 m.p.h., but as the great circle distance between the two places is only 5,341 miles, this is the distance with which the machine will be credited. The record exceeds by 329 miles the record set up in July 1921 by the United States airmen Boardman and Polando, who flew from New York to Istamboul. Squadron Leader Gayford has been awarded the A.F.C. in recognition of the flight, and Flt. Lt. Nicholetts, a Bar to the A.F.C. that he already possesses.

The Fairey Long Range Monoplane is 48 ft. 6 in. in length, 12 ft. in height, and 82 ft. in wing span. It has a totally enclosed cabin that is well fitted out for long-distance flying and it is provided with an automatic pilot. During the record flight, however, the apparatus failed after working for some 27 hours, and consequently the crew had to navigate the machine by the aid of instruments and a sextant that was used to take star sights through a special hatchway in the roof provided for this purpose. The machine can carry more than 1,000 gallons of fuel in its wings, and is equipped with a 530 h.p. Napier "Lion" engine. This engine is practically of the normal Service type, except for a carburetter that is specially tuned to keep down fuel consumption, and pistons that give a slightly higher compression ratio.

The flight was held up for some time owing to the fact that Cranwell Aerodrome is the only aerodrome in the country suitable for the use of a machine carrying a big load of petrol such as that required for this attempt, and it was only possible to take off from there when the wind was blowing in a certain direction.



Luncheon served in the air in a triple-engined passenger aeroplane of Transcontinental and Western Air, Inc. **See also page 270.**

Internal Air Service

An air service between Kirkwall, in the Orkney Islands, Thurso, Wick and Inverness has been started. It is intended for the transport of passengers, while an important branch of the work carried out is the carriage of daily papers to Kirkwall. The service makes it possible for daily papers to be received at 8 or 9 a.m. instead of at 5 or 6 p.m., while various other journals will be available in Kirkwall at noon on publication day instead of on the evening of the day following publication. It is also thought that the Postmaster General will shortly authorise the carrying of mails on the service, which makes the full journey from Kirkwall to Inverness in 50 minutes instead of between 13 and 14 hours which is at present required to travel between the two places by road, steamer, road and rail.

Zeppelin Developments

Dr. Hugo Eckener, head of the Zeppelin Company, recently paid a visit to the Dutch East Indies in order to undertake a thorough investigation of various sites that may be suitable for an airship station, and to examine generally the possibilities of lighter-than-air transport in the district. Dr. Eckener made the visit at the special request of a number of business men in Holland, and if his reports are favourable it is possible that before long there will be a fast airship service in operation between Holland and the Dutch East Indies. The air line would be about 9,000 miles in length.

Negotiations also have been completed between the Spanish authorities and Dr. Eckener for the establishment of an airship base at Seville in Spain. This base is to be used in connection with an airship service between Europe and South America, and also between Europe and North America as the crossing over the North Atlantic by way of the British Isles and North France is impracticable in the winter. Arrangements made by Dr. Eckener called for at least 18 landings a year at Seville, and the duties paid for each landing will amount to about 1,000 gold marks, or about £70. Work on the mooring mast, hydrogen plant and administration offices will start immediately, and it is hoped that the base will be ready for service by 1st August of this year.

Flying Accidents in 1932

Last year there were 32 fatal accidents in the Royal Air Force, resulting in 48 deaths. This is well below the average for the last five years, which is 40.6 accidents involving 61.2 deaths. When this record is taken into consideration with the fact that the flying hours of the R.A.F. have increased considerably, there can be no doubt that it shows an increase in skill of the officers and an increase in safety of flying generally. In civil flying last year there were 13 fatal accidents in Great Britain, and these caused 17 deaths. None of the accidents took place on British regular air transport services.

Whistle to Assist Blind Landings

A method of making it possible for a pilot to determine his position and make a blind landing on an aerodrome has been devised by the General Electric Company of New York. The instrument is known as a sonic marker beacon, and it consists of three special whistles mounted inside megaphones. The apparatus is usually stationed on the boundaries of an airport and during times of bad visibility the whistles are sounded, a motor operated cam interrupting the air supply to the whistles when it is desired to give a code signal. The coding serves the double purpose of giving the pilot the name of the aerodrome and of halving the air consumption of the device. The signal has plainly been heard at an altitude of 2,000 ft., 700 ft. away from the aerodrome, while experiments indicate that with refinements it will be possible for the beam to be heard at altitudes varying between 3,000 and 6,000 ft.

A typical installation of the apparatus consists of two beacons used as boundary markers, and the coding of these is so arranged that the signals combine to form a single note when the aeroplane is equi-distant between the two. The pilot picks up the local airport radio beacon at a distance of five to 10 miles from the aerodrome and is guided by it to the airport. Selecting an altitude of 2,000 ft., he is held by the radio beacon on a line over the centre of the field, and when he comes within 500 ft. of the boundary he hears the first of the sonic marker beacon stations, passes into the middle zone, and after that hears the second marker station. By circling twice at altitudes of 1,000 and 500 ft. he can gain an idea of the size and extent of the field, and approaching at an altitude of 250 ft. he makes a blind landing.

In the case of an airport that has no radio beacon system, four sonic boundary markers are used, the two additional ones being placed at the sides of the field. These beacons are so coded that they are distinguishable from the other pair.

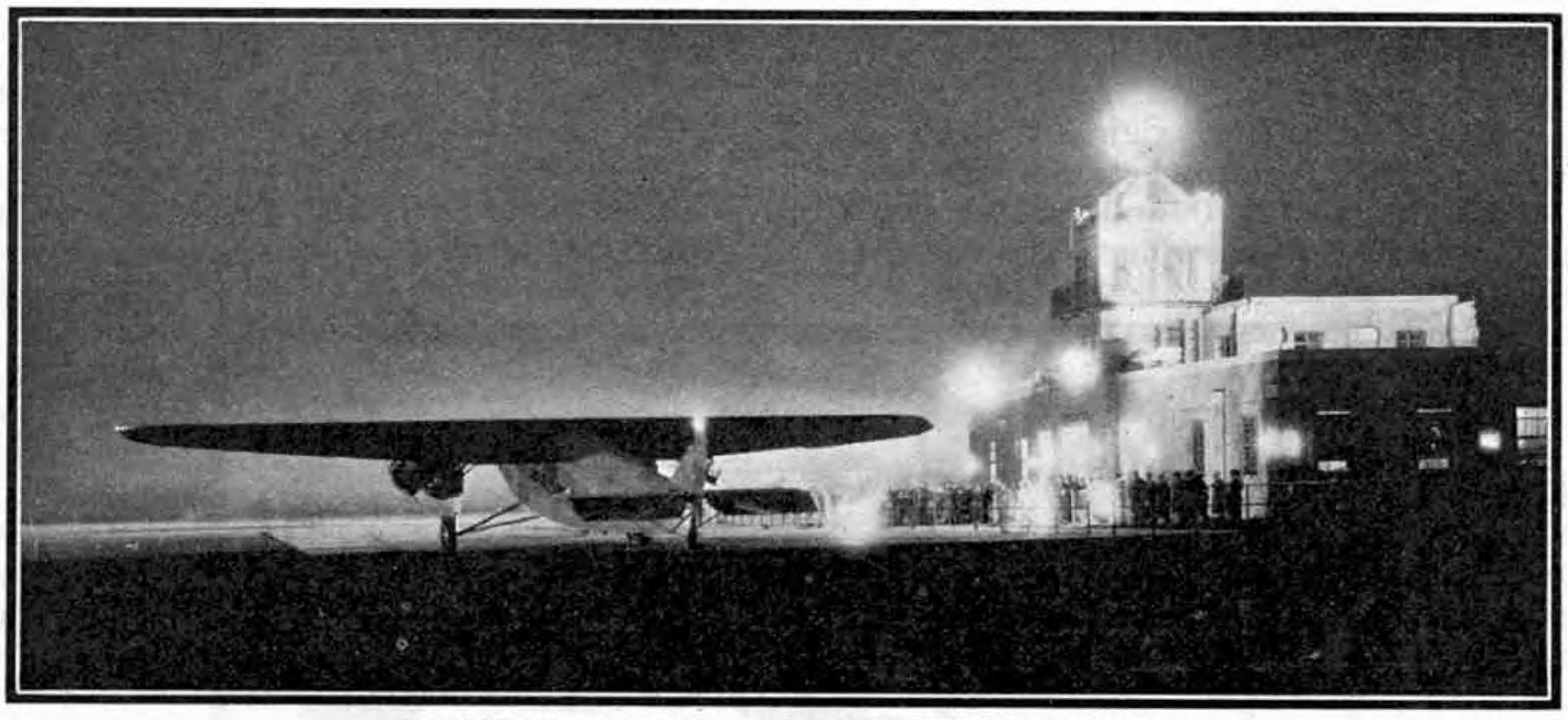
Mails by Glider

Mails from Zurich were delivered some time ago at Milan by a glider. The glider was towed over the Alps behind a D.H. "Puss Moth" and was released over Milan at an altitude of 6,000 ft. A return flight was attempted, but owing to bad weather conditions it had to be abandoned.

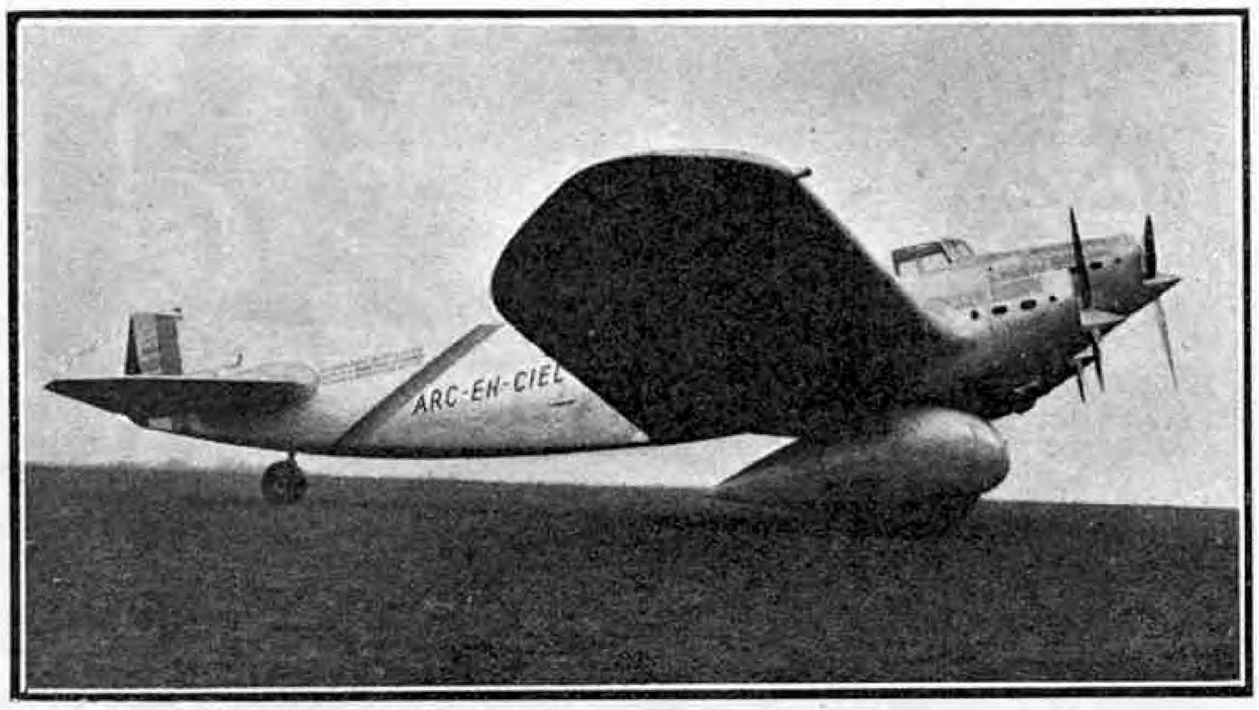
Emergency Signal for Airmen

When an aeroplane lands in bad weather the pilot welcomes the assistance of mechanics or others on the ground when taxying his machine into the hangar. When a really high wind is blowing, for example, the aeroplane gets severely buffeted about if the pilot is not helped; while in some circumstances, such as during a deluge of rain, he cannot see with any certainty where he is going and may taxi into one of the buildings on the aerodrome.

An interesting method of ensuring that pilots are provided with assistance has been put into operation at Brooklands Aerodrome. Here there is a high control tower overlooking the whole of the aerodrome and the surrounding country, and thus a machine approaching Brooklands can be seen when it is some miles away. Whenever the control officer sees a machine in difficulty, or preparing to land in unfavourable weather, he presses a button that causes klaxons to be sounded that are heard all over the aerodrome. Every man at once leaves what he is doing and takes up his place to assist the landing. The procedure for an ordinary bad weather landing is for the staff to take up the form of a semi-circle near the landing-mark; the pilot can then taxi straight into their midst and have immediate assistance. Plans are being worked out for all other emergencies, and they will then be thoroughly rehearsed so that everyone will know his exact duties.



A night landing of one of the triple-engined aeroplanes of T.W.A.



The "Arc-En-Ciel," a Couzinet monoplane that flew from Marseilles to Rio de Janeiro, a distance of 6,439 miles in a flying time of 42 hours 37 min., in January last. We hope to publish a description of this machine in an early issue.

Mollison's South Atlantic Flight

By his recent flight across the South Atlantic from Thies to Port Natal, Mr. J. A. Mollison has become the first person to fly across both the North and the South Atlantic. He is also the first to fly from England to South America, and the first to fly solo the South Atlantic from East to West. The machine was a D.H. "Puss Moth" named the *"Heart's Content,"* and is the same one in which Mr. Mollison flew the South Atlantic. The Atlantic flight was of course, merely one stage in a flight from Lympne to Rio de Janeiro, which took 3 days 10 hours, the Atlantic crossing being made in 17 hours 40 minutes.

While Atlantic flights on the whole fall into the category of "stunt" flights, and are not really to the benefit of aviation, Mr. Mollison's flight should be of rather more value than usual, for he made an extensive tour of South America during which he demonstrated his machine at a large number of aerodromes.

England-Australia Non-Stop

Sir Alan Cobham has recently made public a plan to attempt a non-stop flight from England to Australia. Naturally all the petrol required could not be carried in the aeroplane and this will be refuelled in the air at certain places en route. The machine in which Sir Alan proposes to undertake his flight is the Airspeed "Courier," equipped with an Armstrong Siddeley "Lynx" engine. This machine is a low wing cabin monoplane that has an estimated cruising speed of 130 m.p.h. and is an extremely well streamlined craft. It is provided with a retractable undercarriage.

It is thought that the flight could be made in between five and six days, and that five re-fuellings would be necessary, the first taking place immediately after the start, in order to avoid taking off with a very heavy load. The estimated range of the aeroplane is approximately 2,000 miles.

The 1933 Lockheed "Orion"

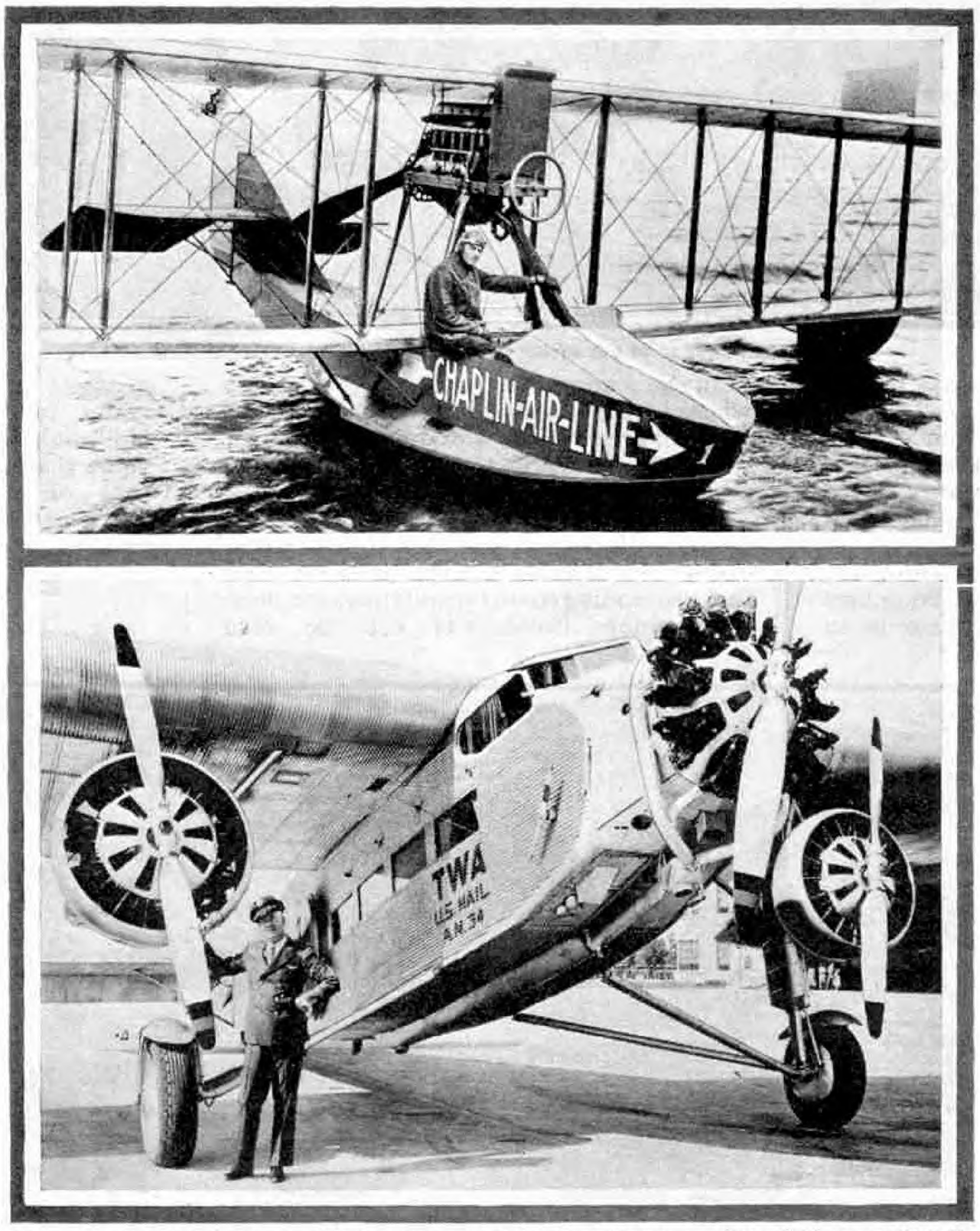
The 1933 model of the Lockheed "Orion" has a cruising speed of 200 m.p.h., which is more than double the speed of the machine five years ago. The new version is equipped with a Pratt & Whitney S1D1 "Wasp" engine, and the machine is better streamlined than the 1932 model, the landing lights being carried inside the leading edge of the wing and the tail assembly being completely redesigned.

Famous Air Line Companies

III.—Transcontinental and Western Air, Inc.

ONE of the best-known American air line companies is Transcontinental and Western Air, Inc. This company, which was started originally as a combination air and rail service operating between New York and Los Angeles, a distance of 2,700 miles, is popularly known as "*The Lindbergh Line*," owing to the fact that Colonel Charles A. Lindbergh, the famous airman, is Chairman of its technical committee. The route followed is now the most direct one between New York and Los Angeles, and is in fact the shortest coast-to-coast air route in America.

When Colonel Lindbergh first started the service his idea was to run it exclusively for passengers, who would be carried by Pullman cars on the railway during the night and in triple-engined aeroplanes by day, the original service between New York and Los Angeles being scheduled to occupy 48 hours. Now, a little more than six years since its inception, the company have reduced the time between these two cities by half, making it possible for letters posted in New York in the morning to be delivered in Los Angeles on the following morning. A freight service moving on the same fast schedules is also now very popular. The passenger service makes the journey in 36 hours, including a stop overnight in Kansas City, Missouri, the actual flying time being 24 hours.



The upper photograph shows a Curtiss passenger flying boat that was used in 1919 to establish the first passenger-carrying air-line in the United States. It was organised by Charles Chaplin, the cinema star. The lower illustration shows a modern commercial machine, the triple-engined Ford monoplane. The pilot in each case is Arthur C. Burns, the first commercial pilot in the United States. We are indebted to Transcontinental and Western Air, Inc., for the photographs accompanying this article, for the one on page 268 and the upper one on page 269.

Although the coast-to-coast service is the most outstanding service of T.W.A., by far the largest number of passengers use the intermediate services for flights such as between New York and Chicago, or between such other places as Pittsburgh, St. Louis, Indianopolis, Kansas City, Tulsa and Oklahoma City. All these places are many hours distant by surface methods of transport, but by air it is possible to shorten the travel time very considerably. In America air service is at present approximately three times faster than rail service, and probably four times faster than other forms of surface transport.

The various routes over which the machines of "*The Lindbergh Line*" operate lie in the rich agricultural and industrial regions of the United States, and more than 20,000,000 people live in the cities served by the company. These provide a large number of passengers, while in addition, because of the vastness of the United States, its inhabitants probably send more of their letters by air mail than do the people of any other country. The transport of mails is therefore one of the most important tasks undertaken by United States air lines, and in an average year more than 10,000,000 lb. of air mail are carried by the 35 air mail operators in the country. T.W.A. state that most of the transcontinental air mail is carried by their machines.

As previously mentioned, the services of the company were originally operated by trains during the night. Now, however, lighted airways stretch right across the continent. These airways are not for emergency use, but are for ordinary routine flying, more than half of the mail carried by the company being flown at night. Passengers also are carried at night, but not to such an extent as are the mails and freight, for comfort has to be studied.

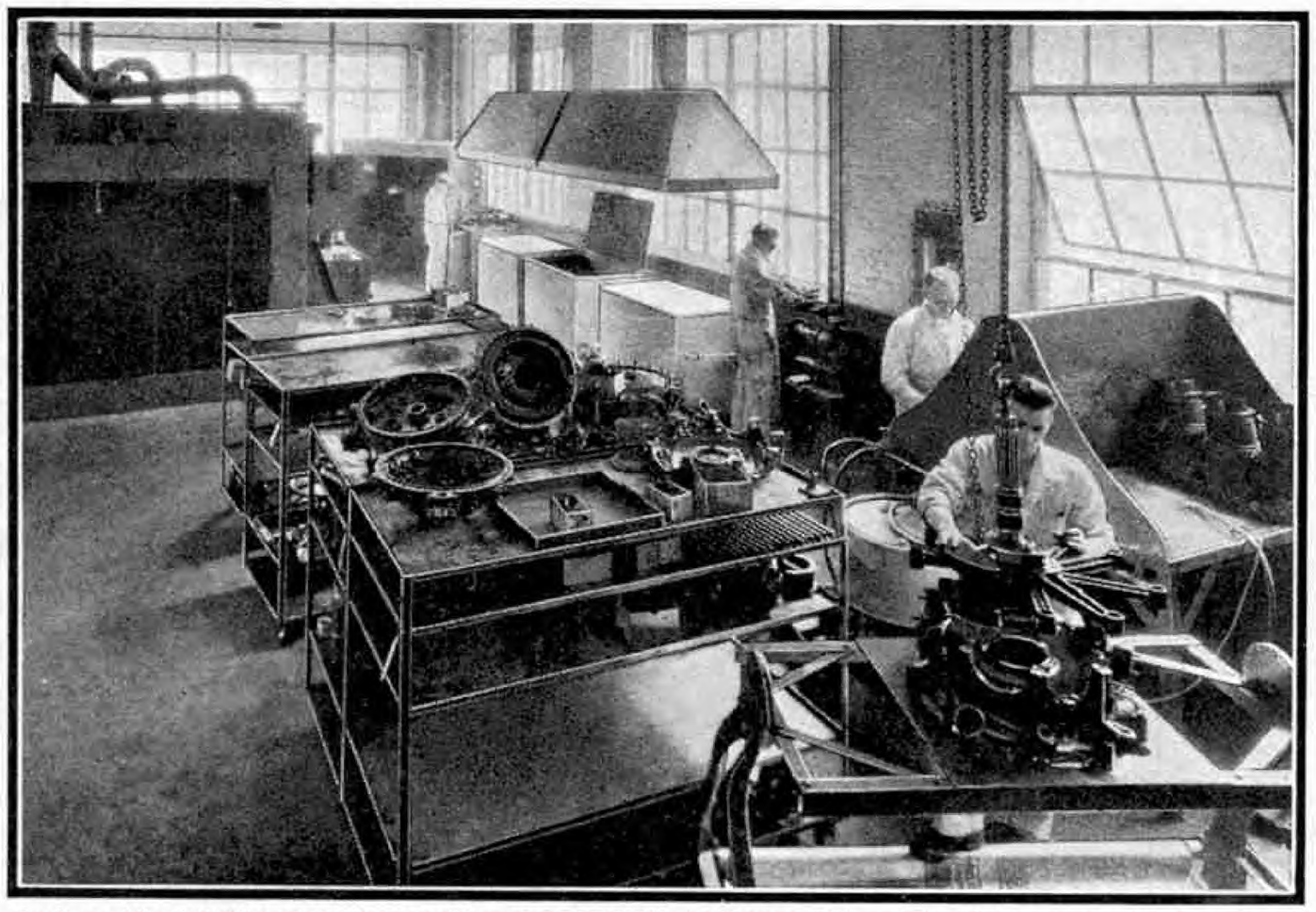
Until recently passengers and mail have formed the bulk of traffic handled by T.W.A., but with the recent formation of an organisation of allied air lines, known as General Air Express, composed of six air line companies in addition to T.W.A., the express carriage of freight by air has increased beyond the most optimistic expectations. Cargoes of hundreds of different types of articles, ranging from printed matter and valuable securities to heavy machine parts, are carried through the air at speeds of from 120 to 150 miles an hour.



The maintenance base and operations headquarters of T.W.A., in Kansas City, Missouri. This airport differs from most aerodromes in England in the fact that it is only five minutes' journey from the business district of the city.

Scenically the territory covered by the T.W.A. air lines is probably the richest in America, for from New York to the Pacific Ocean at Los Angeles, the route of T.W.A. crosses every physiographic region in the United States. The altitude of the country passed over varies from sea level to 12,000 ft., for the picturesque Rocky Mountains and the lower Allegheny Mountains in the eastern part of the country lie directly on the course.

It is generally admitted by large air line operators that it is most economical to keep the number of different types of machines as low as possible. T.W.A. consequently employ Ford triple-engined monoplanes exclusively on the transcontinental services, as well as on some of the shorter branch line operations. These machines are usually powered with Pratt and Whitney "Wasp" engines, each developing 425 h.p., and they always carry two pilots to care for the 12 passengers that the machine accommodates. Constant two-way radio communication is maintained between pilots in flight and ground stations, of which there are now about 20.



A view of the interior of the immense hangar of T.W.A. at Kansas City, where all the company's aeroplanes are maintained and overhauled. The hangar covers an area of more than three acres.

For the mails and freight services there is a large fleet of low-wing all-metal Northrop aeroplanes, each of which is powered with a single 425 h.p. engine. These machines also are equipped for two-way radio communication, and are thus able to receive the constant direction signals of the radio beacons along the route. The beacons are located at a distance of approximately 250 miles from each other, right along the transcontinental route, and are maintained by the Federal Department of Commerce.

Smaller single-engined aeroplanes, such as those built by the Lockheed Company, faster than the Northrop type, are used on the various supplementary services in the south west for flying across the prairies of Texas and Oklahoma between Amarillo and St. Louis.

In order to ensure the safety of all aeroplanes owned by the company, a private meteorological bureau is maintained. The records of this bureau show that over a long period of time its forecasts and observations have been 98 per cent. accurate. A pilot is never permitted to leave the ground without having received a complete weather report on all sections over which he is to fly, and on completion of his flight he has to report on the correctness of the weather forecast previously handed to him.

One of the most interesting features in the operation of T.W.A. is the huge repair and maintenance base at the headquarters of the company in Kansas City, Missouri, half way along the "coasts" line. This is a gigantic building of brick and steel, 400 ft. in length, 300 ft. in width and more than three acres in area, which contains within its walls what is claimed to be the most complete and modern equipment available for the carrying out of repairs to and the maintenance of a large fleet. Some idea of the huge size of this building may be gained from the fact that it was found to be economical to provide a number of the workmen with roller skates to enable them to travel more quickly in the hangar! Several hours daily are saved by this means.

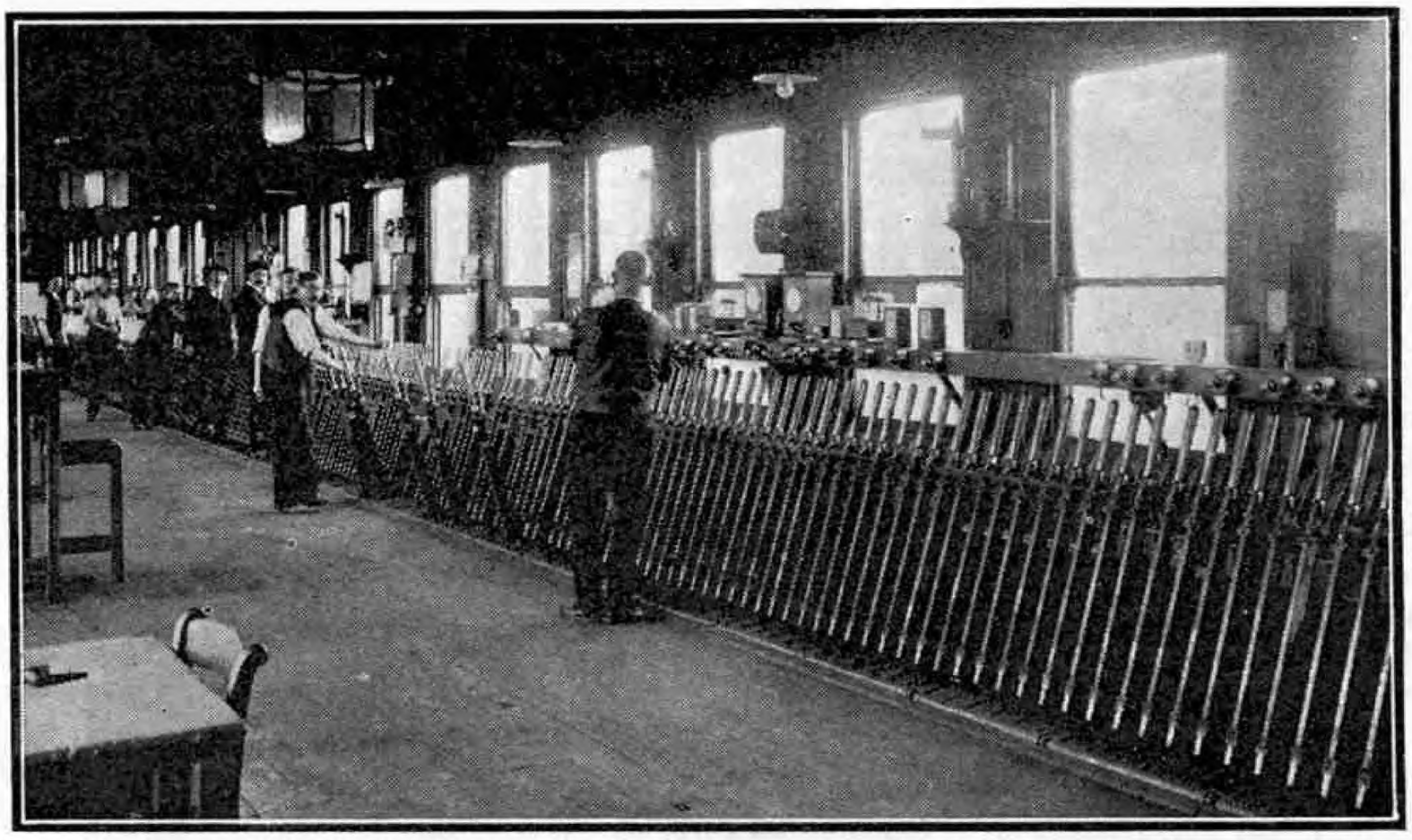
The method of inspection to which all aeroplanes are subjected is most careful and is rigidly carried out. After a machine has completed 25 hours of flying, equivalent to a round trip between Kansas City and New York, it is subjected to a routine inspection. This occupies six men constantly for eight hours, which is equivalent to 48 hours of inspection for every 25 hours of flying time. The workmen subject each moving part, control surface, control cable and the mechanical controls in the pilots' cockpit to

(Continued on page 317



XLI.—A RAILWAY OFFICIAL

CAREERS in railway, civil and locomotive engineering were dealt with in this series in an article that appeared in the issue of the "*M.M.*" for March, 1930. Railways also offer many opportunities for careers of a general commercial type. For instance, departments that employ large staffs are those of the Accountants, the Estate Agents and the Solicitors. For all of these a long preliminary training in the groundwork on which the labours of these departments are based is necessary. Although specialisation is required for the railway side of these professions, the general training is usually obtained away from the railway altogether, in the manner explained in previous contributions to this series, and there is not much scope for promotion from the bottom rung to the top of the ladder.



Signalmen at work in the L.N.E.R. Locomotive Yard Cabin at York. This box contains 295 manually operated levers, a larger number than any other signal box of this type in Great Britain.

In the present article we are concerned with the operating side of the railway, the department that actually deals with the traffic. Since the amalgamation of the railway companies a great deal of re-organisation has taken place and no two railways are conducted in exactly the same manner. The L.M.S.R. have recently introduced a new system by which there is one department that secures the traffic, and deals with advertising, ticket issuing, and staffing of stations and goods depots; and another that handles the traffic, supplying motive power, arranging services and providing signalling. These departments are managed by administrative officials, and the only difference between the L.M.S.R. and other railways lies in the manner in which the duties are divided among the departments.

A word of warning is here necessary. Road competition and the general depression in trade have made the last few years very difficult for our railways, which are faced with falling traffics in nearly every commodity. This has had a bad effect on the recruiting of staff, as it has meant that stringent economies have had to be made. Also, soon after the amalgamations took place, it was found that there was great duplication of stations, offices and services, and a great many of these were done away with, and the staffs reduced. Amalgamation therefore has definitely slowed down promotion, but on the other hand it has meant that some of the biggest jobs are very much bigger than anything that existed before.

The introduction of up-to-date office methods in which machines are used wherever possible, and the abolition of signal boxes by employing automatic working, have been other causes of reduction of staffs. The result of these changes is that it is rather difficult for a boy to get a start on the railway just now; but vacancies do occur, and the present depression cannot last indefinitely. Even the most biassed of railway critics has not suggested that railways could be done away with, and there is no reason to suppose that when trade improves, as it must do some day, the railways will not improve their traffics and therefore require bigger staffs.

Railway work differs from many other occupations, such as the Civil Service or Banking, in that the lines of promotion are not nearly so definite. This is revealed by a study of the careers of most of the leading railwaymen of to-day. No two of them have had the same history, for they have advanced to their present positions along different routes. Although it is in some ways an advantage that several avenues of promotion are available, it is more difficult to know how to start to reach the desired goal. It is, however, still correct to say that no other career offers better possibilities for a

promising boy to start in the humblest of positions, with a good chance of finally attaining something really good. At the same time it also may be said that on the railways to-day there is very little hope of inefficiency being bolstered up sufficiently to enable a man to hold a key position. The administrative officials are without exception men who know their work as the result of years of hard training. To a certain extent seniority does count, but for the big positions it plays a small part.

Promotion on the railways is usually slow, and although this is irksome, and of course means that many able men never get very far, it also means that a man gets a good grasp of new work before he gets a second shift, and hence the training tends to be very thorough.

As in most other occupations, the lack of a good education is a great drawback on the railway, for it makes the acquiring of new knowledge more difficult. A boy who hopes to succeed on the railway should have a few years at a secondary school if at all possible, and as a proof of the attainment of a certain standard should hold the Matriculation Certificate or the Higher School Leaving Certificate, or an equivalent qualification. Many boys start on the railways without any of these qualifications, but they are always working against a handicap.

Now let us look for a moment at one or two typical railway careers. Suppose a lad gets a start at a small country station as a junior porter. He will get some very humble jobs, such as sticking on labels, cleaning lamps, attending to the fires, wheeling luggage, and so on, but nobody will prevent him from learning. He will soon make friends with the nearest signalman, and we shall find him spending many an hour of his spare time in the signal box, learning what the bell signals mean, what the different coloured levers are for, and how trains are passed from cabin to cabin along the line. He will take advantage of the classes for block signalling that the companies hold at different centres, and he will be allowed free travel, and possibly time off, to attend, say, one night a fortnight.

When he hears of a vacancy for a porter signalman the boy will apply, and on being examined verbally by an Inspector will no doubt satisfy the official that he is able to carry out the duties. He will be on probation for a time, but if he has studied his part he should meet with no difficulty, and before long will find himself in charge of a small signal cabin on a branch line where trains are scarce, and he is required to assist in station duties as well.

In his new position he still carries on with his signalling classes, and each year passes the examinations for which certificates and prizes are given. Presently a vacancy for a signalman occurs, and again he should have a good chance of promotion, after verbal examination by the Inspector, although of course he cannot expect to get every job that offers. He will miss sometimes.

With a good clean record as signalman, and after keen observation of the operation of traffic and study of the more complicated working in bigger signal boxes, he becomes eligible for a relief signalman's job. He then goes about in a district filling a vacancy temporarily wherever illness, holidays or promotion has left a blank. In order to make a success of this post he must be reliable, adaptable, and quick to learn the working of each box.

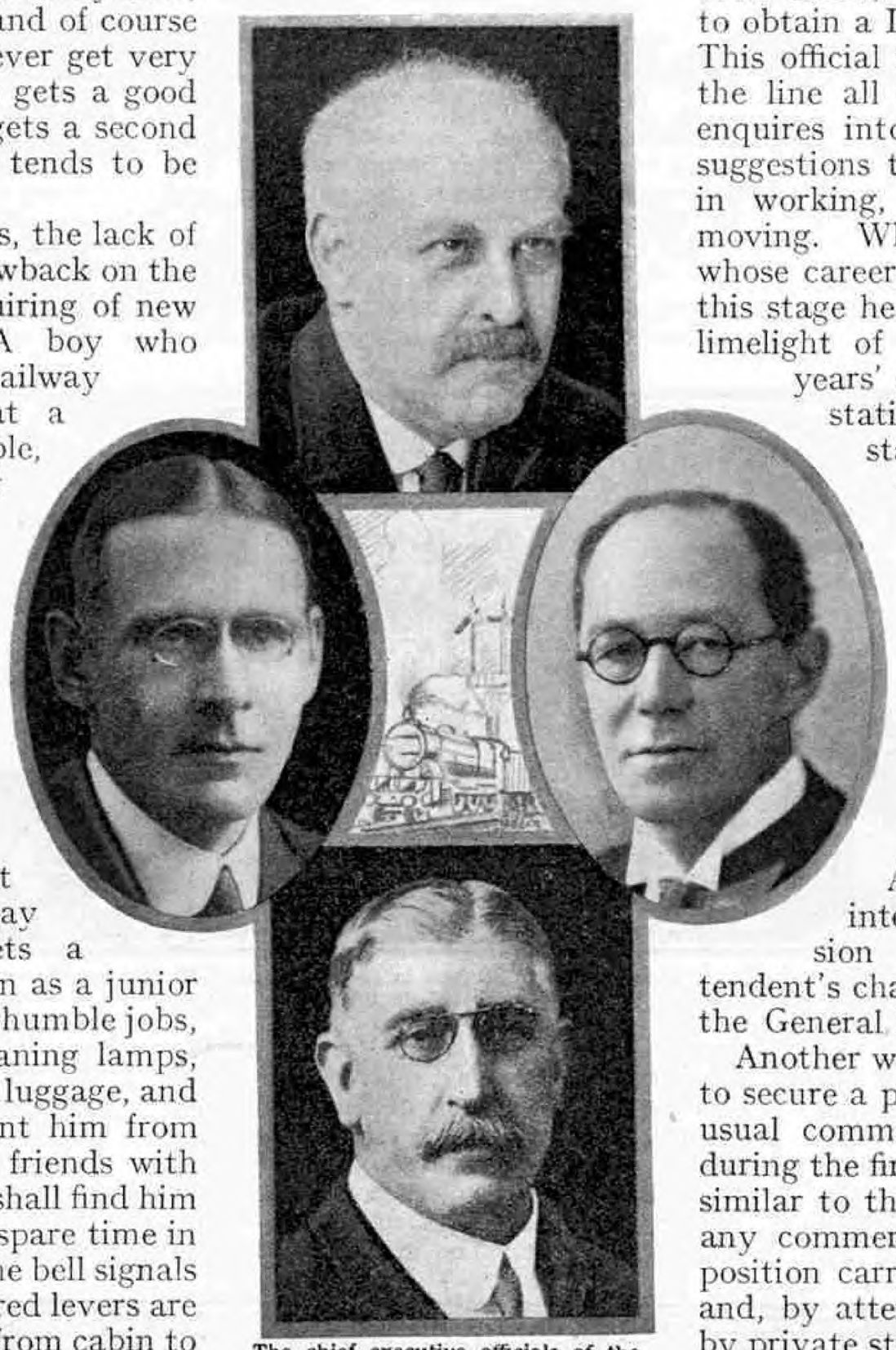
If in the meantime he has secured a good grasp of traffic working and a thorough knowledge of the Railway Rule Book, he may be fortunate enough to obtain a District Traffic Inspector's job. This official is responsible for getting over the line all the traffic in a district. He enquires into delays and mishaps, makes suggestions to his Chief for improvements in working, and generally keeps things moving. When the ambitious railwayman whose career we are following has reached this stage he is beginning to come into the limelight of the Head Office, and a few years' good work should bring him a stationmaster's job at a fair-sized station, from which he moves in time to a larger one. A stationmaster is an important official, for even at small stations he has a good many men on his staff, and at big London termini there are many hundreds under his control.

From stationmaster at a large station the next move might be to an office job as Assistant to a Divisional Superintendent. Then follows succession to the Divisional Superintendent's chair, and one more move reaches the General Managership.

Another way of starting on the railway is to secure a position as a junior clerk. The usual commencing age is about 17, and during the first one or two years the work is similar to that done by an office boy with any commercial firm. If a clerk in this position carries out his work satisfactorily and, by attendance at evening classes and by private study shows that he is worthy of promotion, he may become a senior clerk. After spending a few years in this position he may be promoted to the Chief Clerkship of a section. The next stage is to be made Chief Clerk to the Head of a Department, and it is from men holding these positions that the Assistant Heads of Departments are frequently selected. Then follows promotion to Assistant District or Divisional Chief, and so eventually to District Chief, and later to Divisional Chief. Of course every junior clerk who enters the employment of a railway company cannot expect to become a Divisional Chief, but all have equal opportunities of doing so.

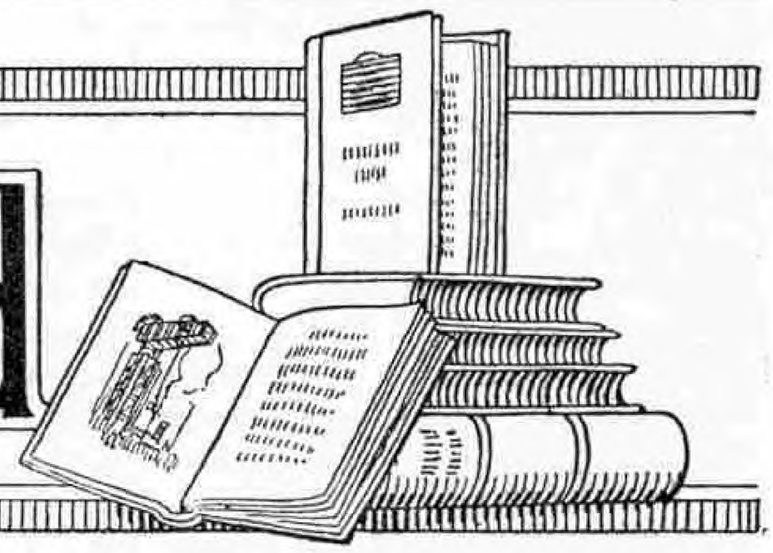
A boy who wishes to enter the railway service in any of these ways should write to the Superintendent of the Line in his division and ask if there is any vacancy to which he may be appointed. If he wishes to get into any particular office, but is only given an opportunity of entering some other department, he should not turn it down, for provided that he works hard and studies in his spare time, his prospects of

(Continued on page 317)



The chief executive officials of the four British Railways. Top: Sir J. C. Stamp, G.B.E. (L.M.S.R.). Left: Sir J. Milne (G.W.R.). Right: Sir R. L. Wedgwood, C.B., M.Inst.T. (L.N.E.R.). Bottom: Sir H. A. Walker, K.C.B., M.Inst.T. (S.R.).

Books to Read



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"The Book of Natural Wonders"

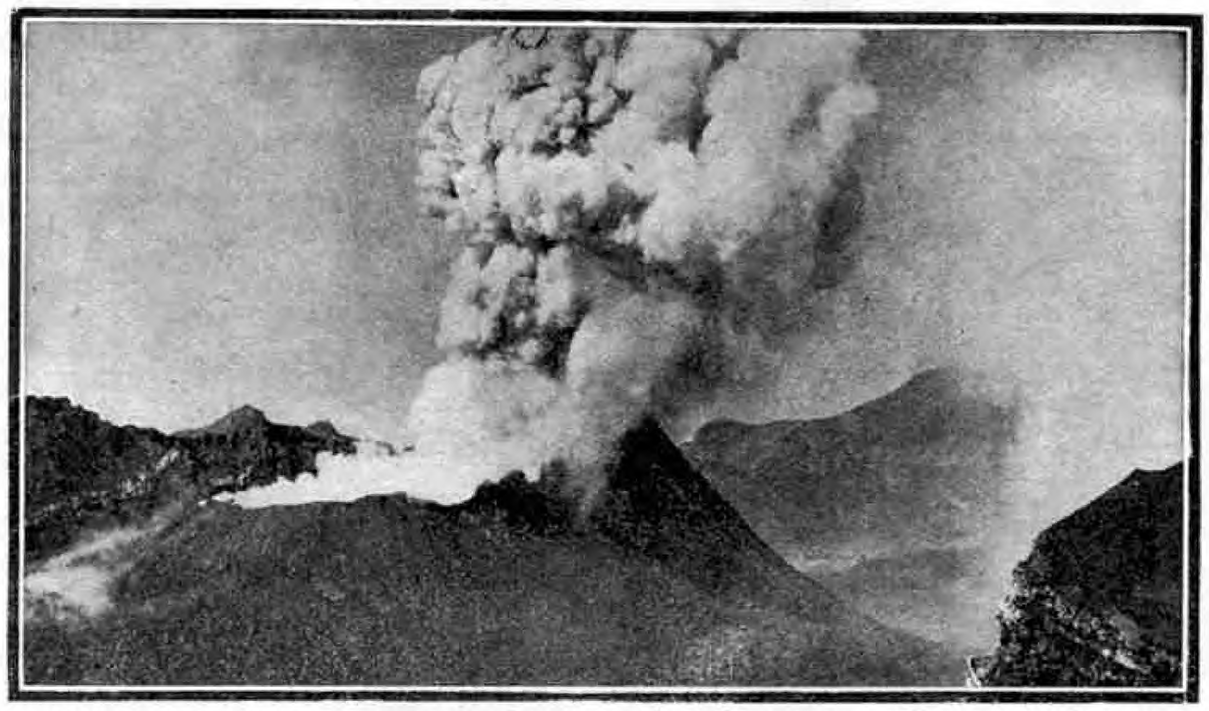
By ELLISON HAWKS. (Harrap, 7/6 net)

This latest volume from the pen of the Editor of the "*M.M.*" covers a truly astonishing range of subjects. It presents a picture of the Earth from almost every point of view, and maintains a high level of interest from first to last.

The author commences with the Earth as a planet, and shows us how insignificant it is in relation to the Universe as a whole. The Sun, without which there could be no life on the Earth, appears to us the most gigantic of all celestial objects, and yet it is only a star of comparative unimportance in the Universe. From the star nearest the Earth, the Sun would look like one of the brighter stars; but from most of the other stars it would be lost among the thousands of suns by which it is surrounded. The 1,500 stars we can see with the naked eye on a clear night are only a tiny fraction of the billion that are photographically visible with the 100-inch reflecting telescope of the Mount Wilson Observatory in California. The question of overcrowding rises at once in our minds, and we are relieved to learn that the risk of collision between two stars is hardly as great as that of three flies crashing into one another if they had the whole continent of Europe to themselves in which to exercise!

Having stimulated our imaginations by these stupendous facts, the author proceeds to deal with the Earth's movements. Not only is our planet travelling along its orbit round the Sun at a speed of over 1,000 miles a minute, and rotating on its axis so fast that a point on the equator has a speed of 1,000 miles an hour relative to the axis, but also it is rushing through space along with the whole solar system at 750 miles a minute! As for the Earth's distance from the Sun, the statement that this averages 92,870,000 miles conveys little; but we can form some idea of its immensity when we are told that a high-velocity shell fired from the Earth would not reach the Sun until 4½ years later! This fascinating section of the book deals also with the manner in which the Earth is measured; explains latitude and longitude, and gives many curious and interesting facts about the calendar and its history.

The author now leaves problems of space and time and commences a tour of the Earth in which he shows us its endless sequence of wonders and explains their mysteries. We are told how the unwritten history of the Earth is displayed in its rocks, and how fossils show us prehistoric weather conditions and reveal the gigantic monsters that once wallowed in the ooze, or craned their long necks to reach the succulent foliage that grew high up in the dense primeval forests. The upheavals through which the Earth has passed during its times of cooling and pressure have had extraordinary results. Fossils of creatures that once lived in the sea are found high up in the Alps, and the summit of Snowdon, we are told, was once the bottom of a valley 29,000 ft. deep! Mountain ranges higher than the Alps have been completely swept away, and the material produced by their destruction has been transported far out to sea to form the nucleus of great mountains of the future.



Vesuvius in eruption: Photograph of the cone in 1931. (From "The Book of Natural Wonders" reviewed on this page.)

Mountains have had an intense fascination for men from the earliest times. For many centuries they were regarded with superstitious fear as being the dwelling-place of supernatural beings. We no longer hold beliefs of that kind, but the fascination of the mountains still remains. The author gives us an interesting description of mountaineering in the Alps and a thrilling account of the appalling disaster that followed the conquest of the Matterhorn. From the Alps we pass on to the Himalayas, and the graphic description of the terrible conditions encountered by previous expeditions that have attempted to climb Mount Everest enables us to realise something of the ordeal that confronts the expedition now on its way to grapple with this peak.

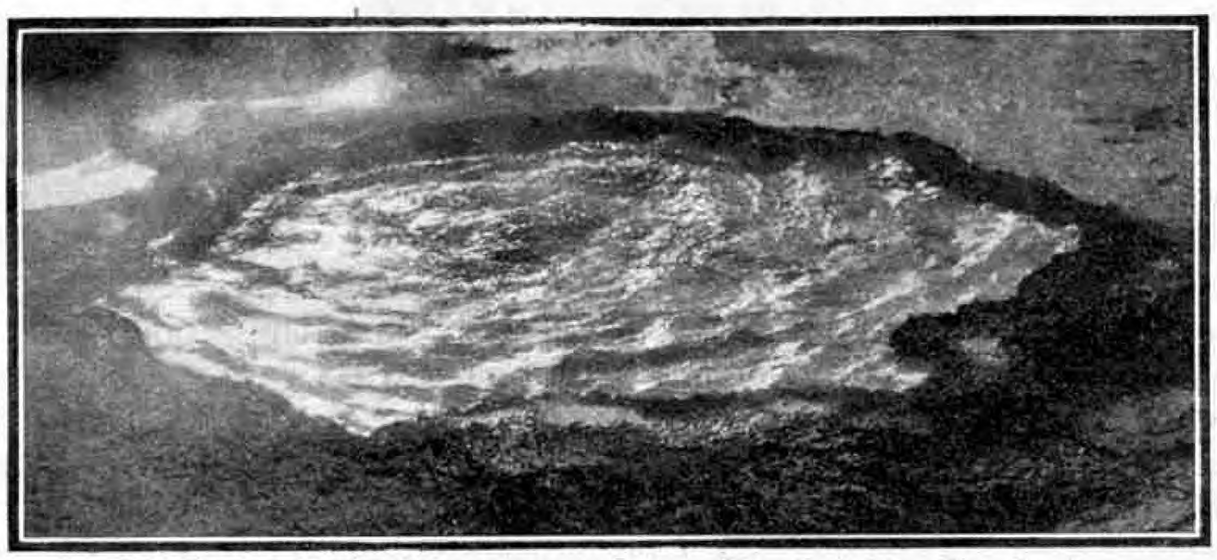
From mountains we pass to earthquakes and volcanoes. In this country we are so free from anything more than an occasional slight earth tremor that it is difficult for us to realise the horror of such a convulsion as that which wrecked Napier, New Zealand, in February, 1931. The author describes some of the greatest volcanic eruptions in history, and makes us realise something of the terror inspired by these outbursts of long-imprisoned subterranean forces. Fortunately the Earth is now passing through a comparatively peaceful period, and out of the thousand or so volcanoes now in existence only about 350 are active.

After volcanoes, geysers and hot springs seem quite harmless and friendly, and it is interesting to read of the ingenuity of the man in Iceland who uses hot springs to warm his greenhouses and thus grows splendid crops! A natural wonder of a different type, and which has the merit of being commercially useful, is the Asphalt Lake of Trinidad, the uncanny material of which is used for road-making purposes all over the world.

Concluding chapters deal with the great plains and prairies of the world and include an interesting section on the North American Indians. Finally we come to the Meteor Crater of Arizona, a huge depression in the earth resulting from the impact of a gigantic missile from outer space.

The illustrations to this book are as remarkable as the text. Good photographs in profusion accompany each chapter, and in addition various matters are explained by effective line illustrations.

(REV.) J. H. MARTIN.



A Boiling Pool at Whakarewarewa, Rotora, New Zealand. (See above).

"The Nightingale—Its Story and Song"

By Oliver G. Pike, F.Z.S. (Arrowsmith. 10/6)

The name of Oliver Pike is well known to bird lovers all over the country on account of his justly popular lectures and sound films. In this book he deals with the story of the nightingale and other familiar song birds of Britain. The nightingale is probably the most fascinating song bird in the world, and its melody has captured man's imagination since the beginning of history. From the earliest days poets have sung its praises, and even in Greek mythology we read of Philomela, the daughter of a king of Athens, being changed into a nightingale.

The nightingale comes to this country from Africa in the month of April. It is about 6¼ in. in length and is reddish brown or rich chestnut in colour, with a whitish breast. In many of its actions it resembles the robin, but its movements are not so rapid. It is found in woods with plenty of bramble undergrowth, in lanes, coppices and hedges.

The author points out that it is a mistake to suppose that the nightingale only sings at night—in fact, he thinks that the best time to hear its song is between one and three o'clock in the middle of the day. He has heard some of the best music at this time. The bird has the habit of singing at night when all other singers are silent and this has led to its world-wide reputation as a songster. Incidentally, thousands of people in this country who live in places where the nightingale is never to be seen have listened to its notes on the many occasions on which its wonderful song has been broadcast.

Having dealt with the nightingale at some length, Mr. Pike passes on to describe a variety of other birds that are famous in the English countryside. Of these he has much information to give us and many anecdotes to tell. Each chapter commences with a useful paragraph giving the bird's description and chief characteristics, which particulars will help those interested in identifying the different birds.

There are 24 illustrations from photographs taken by the author, showing birds in their natural surroundings, and the book has a useful index.



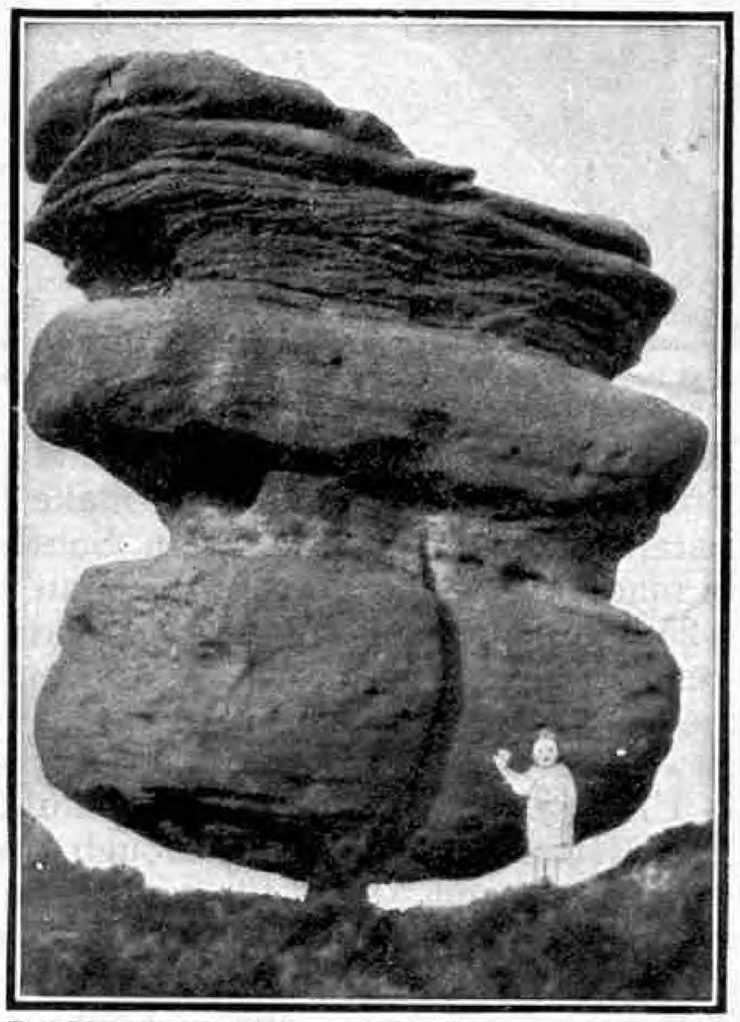
The Male Chaffinch on the nest. This is one of the commonest birds to be found in the country, being far more numerous even than the house-sparrow. (From "The Nightingale—Its Story and Song," reviewed on this page.)

"So This is Science"

By H. F. Ellis (Methuen. 5/-)

In his Preface the author states that it has been his endeavour in this book to present the subject matter in as simple and readable a way as possible. He warns us, however, that he cannot be held responsible for any loss or damage incurred through a too implicit reliance on the information contained in the book! The warning is perhaps unnecessary, for immediately we open the book it is obvious that Mr. Ellis has no intention of compiling a text book, nor of seriously instructing us! The volume is, indeed, a wild burlesque on the methods of popular workers in science—it is a compound of ridiculous errors and the most light-hearted kind of nonsense imaginable.

For those who find Einstein irksome, the book is a perfect mine of hitherto unpublished (and, of course, totally erroneous) information about every aspect of the natural world. The subjects range from Scheftel's remarkable experiment with the lobsters to a detailed description of the full dress uniform of the Astronomer Royal! As an example of some of Mr. Ellis's definitions we may mention that of the Meridian, which he describes as being "a thing on which the Astronomer Royal generally sits when on duty at Greenwich. This cancels anything I may have said about it earlier in this chapter!"



The Idol Rock, Brimham, Yorkshire. Denudation has removed large quantities of material from around this great rock, and subsequently wind-driven sand has carved it into its present curious form. (From "The Book of Natural Wonders" reviewed on the previous page.)

It would certainly be impossible for anyone to read this book and remain in the dumps. There are chuckles on every page.

"More Concert Items"

By H. L. Davies (Brown, Son & Ferguson. 1/6 net)

Scoutmasters or Cubmasters in search of suitable material for concerts will find many of their problems solved by this book, the second volume of this kind Mr. Davies has produced. The first gave valuable hints on concert training and preparation, and included items for performance at camp fires as well as at concerts. The new book is chiefly devoted to interesting short plays, and there also are monologues and short scenes that will amuse Scout audiences when well presented. The plays have been specially planned to be performed without the aid of elaborate costume, and detailed hints are given for the making of the more difficult accessories of this kind that are needed.

"How Life Goes On"

By A. G. Whyte, B.Sc. (Watts & Co. 1/6 net)

There is scarcely a corner of the earth where some living thing has not managed to make a home for itself, and plants and animals have found an amazing variety of ways of keeping on from one generation to another. There are many striking differences in the forms of life they adopt, but from the lowest to the highest they are linked together in one great family; and man, the highest of all, can learn something by studying even the humblest of living creatures.

Mr. Whyte has set out to show what can be learned in this manner from the wonders of plant and animal life. The earlier chapters of his book are devoted to the fascinating microscopic creatures that swim in our pools and rivers, and deal chiefly with amoeba, tiny jellylike animals that have endured for millions of years, probably because of the delightful simplicity of their way of life.

Charmingly written accounts of the more complex creatures of the microscopic world lead on to a description of the extraordinary means adopted by higher creatures to ensure the continuance of their race. Fishes are first dealt with, and the author divides these into fish that are wasteful, producing young in enormous numbers in order to prevent the extinction that otherwise would be the result of their astoundingly heavy death roll, and those whose progeny are few, but are looked after with great care and given the best possible chance of succeeding in life. Interesting details are given of the productivity of some of the wasteful fishes. The turbot appears to be the champion spendthrift, for a single fish may lay as many as 9,000,000 eggs in a year and all but one or two of these are devoured before they can grow up!

Finally we come to the higher animals, who owe their success in the struggle for existence largely to the incessant care they devote to their successors of the next generation. The highest creatures of all devote most time to schooling their young, who take longer to grow up than those of simpler creatures. Many readers will be surprised to learn that a lion cub must pass through an "apprenticeship" of a year and a half in which to learn how to stalk its prey and to strike its victims with claws and teeth in the right places.

The book is attractively written and is profusely illustrated.

London "Underground" Railway Developments

Piccadilly Tube Extensions

By "Observer"

THE enterprise of the London Electric Underground Railways is unbounded. They are for ever reaching out into new territories, and a wisely-adventurous policy of improvement and development is steadfastly pursued. Although the best possible may be realised to-day, it must be improved upon to-morrow; the standard of efficiency, alike in equipment and operation, is continually being raised.

The latest developments in the extensions of the Piccadilly line, and the improvements on the older "District" lines connecting with it, together with the reconstruction, including the installation of escalators, of many underground stations in the central area of London, afford clear evidence of the enterprise that animates the "Underground." The northern extension from Finsbury Park was opened in September last as far as Arnos Grove, a distance of 4½ miles, and in the course of another month or two it will be continued to Enfield West, and by midsummer to Cockfosters, the terminus, so adding a further 3¼ miles. Meanwhile at the other end the extensions westward from Hammersmith have been carried through and connections made with the District Railway, with the result that Piccadilly Tube trains are now working through from South Harrow, and from Hounslow, to Arnos Grove, a distance in each case of 22½ miles, which is the longest run made by any tube train. This will be increased to over 25 miles when the further extension to Cockfosters is opened.

Facts like these show convincingly the vast extent to which greater London has grown and how remarkable has been the development of the London Underground Railways in catering for travellers in the great Metropolis. The earliest Underground lines, the Metropolitan and Metropolitan District, were opened between 60 and 70 years ago, but although called "underground," these are practically surface lines, their tunnels being constructed at shallow depths by the "cut-and-cover" method of tunnelling. For many years these lines were operated by steam locomotives—as passengers knew only too well as they journeyed laboriously through tunnels thick with steam and smoke and sulphurous fumes. Not until 1890 was the first electric tube railway opened, the City and South London Railway, running from the Bank to Stockwell. In 1900 was opened the Central London Railway, from the Bank to Shepherds Bush. It was known as the "Twopenny Tube" because at first a uniform fare of that amount was charged.

Within the next ten years the other tube railways, familiarly known as the "Bakerloo," the "Piccadilly" and the "Hampstead & Highgate" lines, were made. All have since been extended considerably beyond their original limits, so that now, deep below the surface of London, there is a whole network of tube railways running in all directions. The tube railways, together with the Metropolitan District, are now all under one united management that owns 81¼ route miles of track, with 128 stations, and has 2,368 passenger coaches in which are carried the amazing total of 400 million passengers a year.



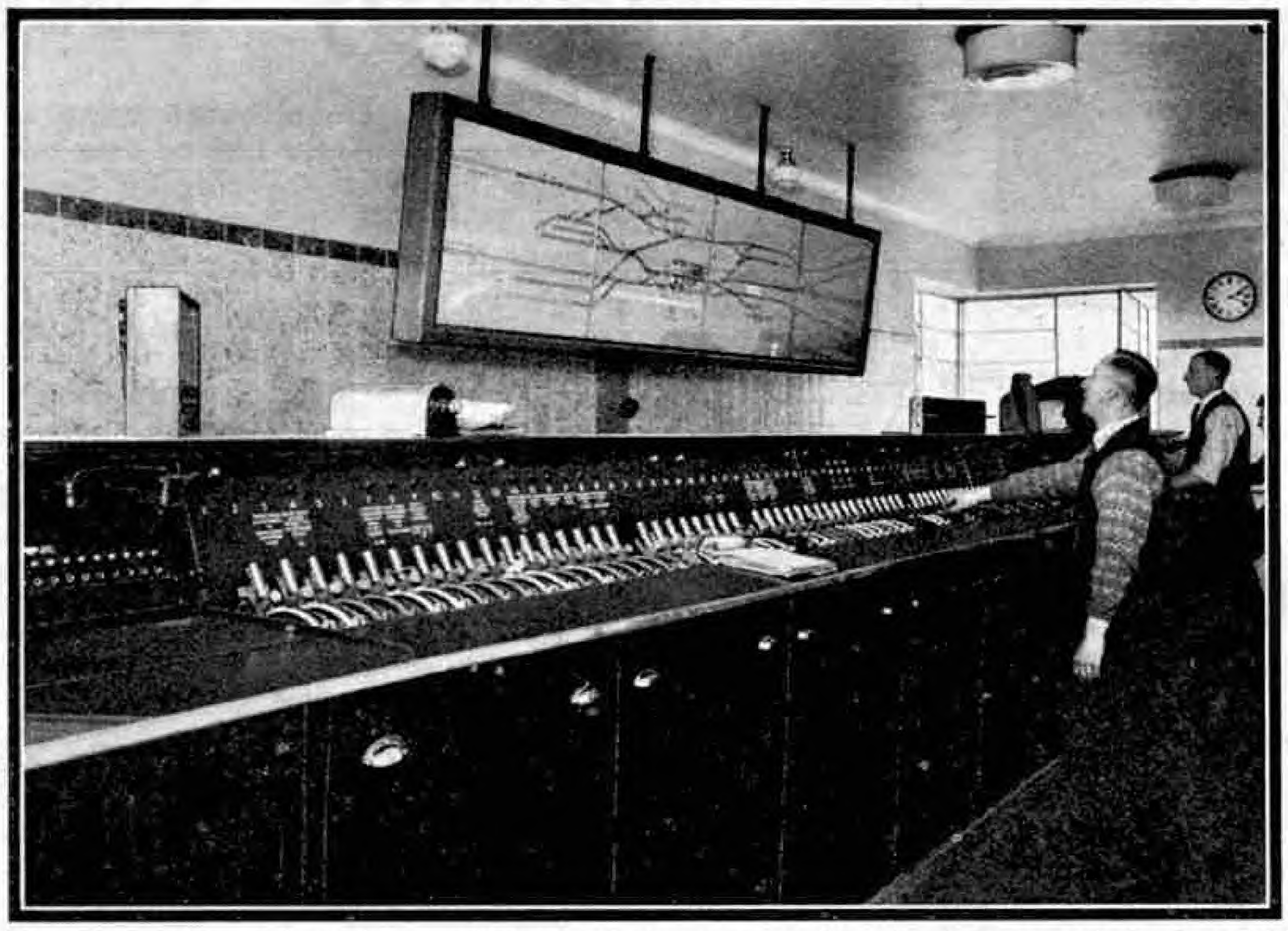
A Piccadilly Tube train at the rebuilt Sudbury Town station. For the illustrations to this article we are indebted to the London Underground Railways.

In carrying out the extensions of the Piccadilly line the "Underground" has used to the full the experience gained in the past and has sought to effect improvements in almost every detail of working and equipment. Alike in the track, stations and rolling stock, everything has been done to ensure swift, safe and comfortable travel for the passengers who use the line. To make the journey over the full extent of the line from South Harrow to Arnos Grove, as I did recently, is an experience full of interest. The tube tunnels extend for little more than half the whole journey, and at each end the line runs out in the open through country of rural beauty, with undulating hill and dale, adorned by many noble trees. Already in these areas hundreds of new houses are springing up, and although that means the loss of some of the charm of the countryside, it also means for thousands of people healthful homes in the spacious country in place of drab dwellings in crowded City streets.

From South Harrow through Sudbury and Alperton the line runs through pleasant scenery. Stations are more widely placed than in the city sections, and between the stations a notably high speed is attained. Acceleration is rapid, and deceleration for the stops is done with ease as the air brakes are electrically operated and thus all the brakes throughout the train are applied simultaneously. Running at all speeds is smooth and

remarkably free from noise, and the pleasure of travel is increased by the diversity of colours and patterns used in the upholstery of the new cars. Almost all the stations on this old District line have been rebuilt in modern style and made ready to deal with the greatly increased traffic that the improved services undoubtedly will bring. At Park Royal the G.W.R. line to Birmingham is crossed by a bridge, and a little later, between North Ealing and Ealing Common, a bigger bridge spans the main line of the G.W.R. to the West of England.

Acton Town is an important junction station, and has been entirely rebuilt and remodelled to deal with the new traffic conditions. Here the line from Hounslow and Northfields comes in, and from here, forward to Barons Court, four tracks run side by side, two being used by Piccadilly tube trains and the other two by District trains. The timetables provide that only District trains call at the intermediate stations between Acton Town and Hammersmith, the Piccadilly trains running non-stop over this section. This arrangement certainly makes for fast travelling on the part of the tube trains, and a maximum speed of 40 or 45 miles per hour is usually attained. Leaving Barons Court, the next station beyond Hammersmith, the line descends somewhat steeply and the train plunges into the tube tunnel, a fact made apparent by the increased noise and the slight air-pressure on the ears. And now stops are frequent, but with the smartness that characterises "Underground" travel we journey forward via South Kensington, Hyde Park Corner, Piccadilly Circus, Holborn and King's Cross to Finsbury Park.

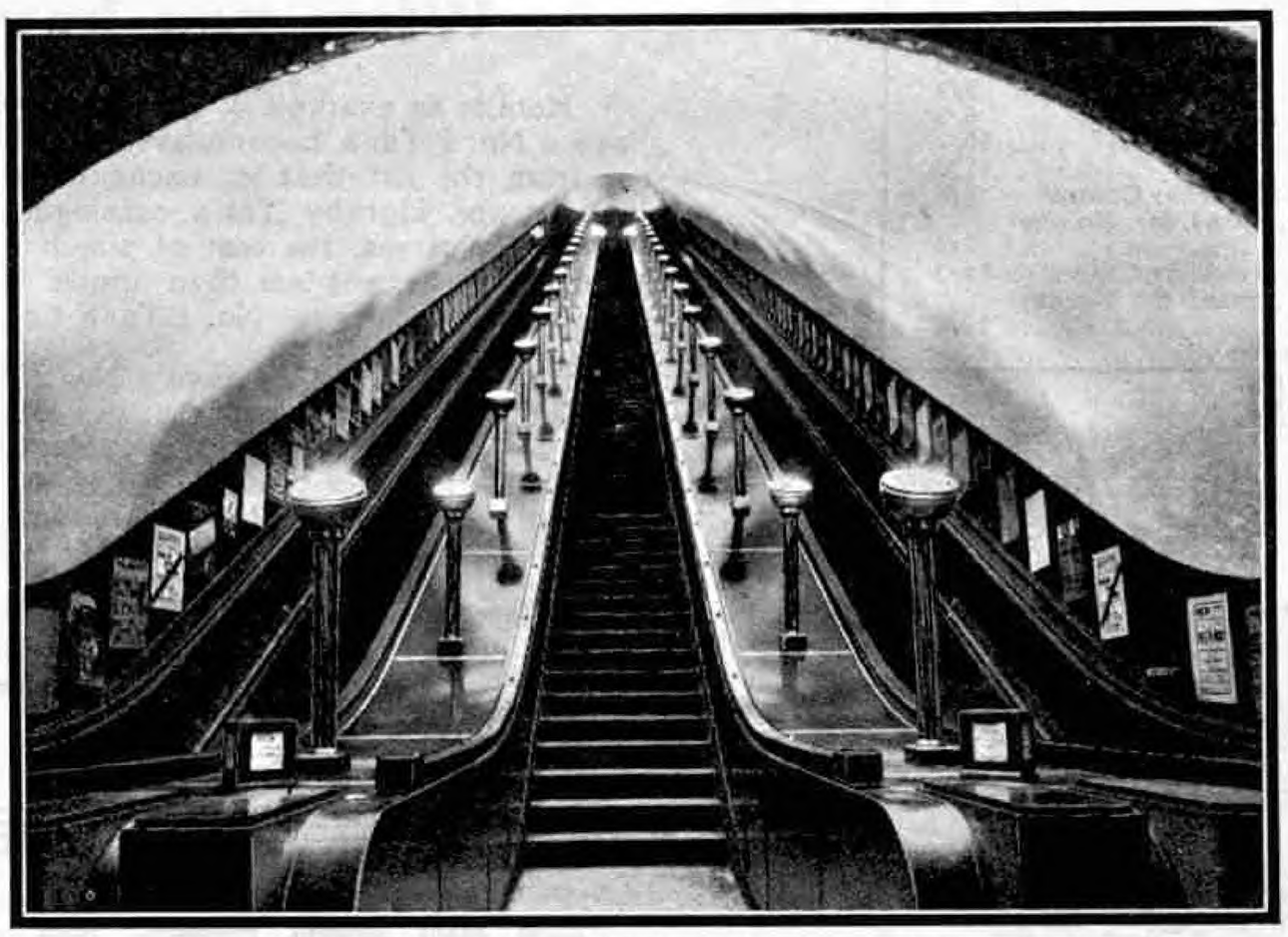


The signal cabin at Acton Town, which has 119 levers and is the largest on the "Underground" system.

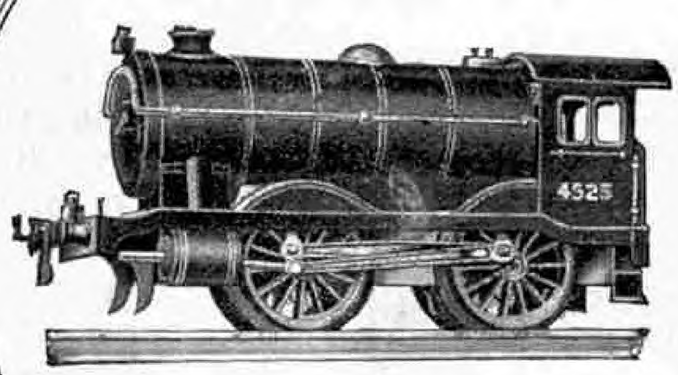
From Finsbury Park onward the train runs for the rest of the way over the newly-opened section of the line, and with increased interest I noted the features specially worthy of attention. The running of the train became even smoother than before, the new permanent way being of an improved construction, with running rails, which weigh 95 lb. per yard, in 90-ft. and 60-ft. lengths. Another feature that promotes speedy and smooth train operation is the exceptionally easy curvature employed. Except a short length of 15 chains radius at Manor House, no curve is of less than 20 chains radius, and the running tunnels are 12 ft. in diameter, save in the straight or on curves of 60 chains or over, where they are 11 ft. $8\frac{1}{4}$ in. Hitherto the latter diameter has been the standard for curves of 20 chains or over. To reduce air pressure on trains entering at speed, the tunnel mouth at the northern end of the tube at Tewkesbury Road is 16 ft. in diameter, instead of the customary 12 ft., and is of bell-mouth form.

For the first four miles from Finsbury Park the line runs in twin tunnels and includes the four new stations, Manor House, Turnpike Lane, Wood Green and Bounds Green. At Tewkesbury Road, about half-a-mile beyond Bounds Green station, the tunnel section ends, at a level 48 ft. higher than at Finsbury Park. A short length of cutting and a viaduct project the line on to a 175-ft. girder bridge by which it is carried over the North Circular Road; and then by a longer viaduct and a cutting it reaches Arnos Grove station, the present terminus.

After alighting at Arnos Grove—the overall journey having taken about 56 minutes—I observed with some care the station buildings and equipment, and later, on my return journey, I was at pains to call at each of the new stations and examine their architecture and the various appliances used in their operation. All are decidedly modern, but they are anything but uniform. The main booking hall buildings are prominent features but they differ considerably in design. Turnpike Lane is rectangular, Wood Green elliptical, Bounds Green octagonal, Arnos Grove circular. Manor House station is of the basement type, on the lines of Piccadilly Circus. The interiors of the booking halls are spacious and make for free movement, and conveniently placed automatic ticket machines help the rapid booking of passengers. The escalators are of a greatly improved type, capable of a speed of 180 ft. per minute. An exception has been made at Turnpike Lane where a pattern with a maximum speed of 120 ft. per minute has been fitted, as the distance from the surface to the platforms is less at this station than at



The escalator at Bounds Green station. This is capable of a speed of 180 ft. per minute.



Hornby No. 1 Special Locomotive

BOYS! Here is a plan to secure a fine new Hornby Locomotive

You have probably been using a Hornby Locomotive for some years and would like to own one of the fine new models that now figure in the Hornby Catalogues. The object of the new Hornby Locomotive Part Exchange Scheme is to help you to do this.

First of all, carefully study the latest Hornby Train Catalogue, and select the new up-to-date Hornby Locomotive you want; then carefully pack up your old Hornby Locomotive and post it to us, enclosing your order for the new one and the necessary remittance. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the accompanying list from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase.

If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you all the information you require.

The allowance that will be made for your old Locomotive is shown in the list of Part Exchange allowances for Hornby Locomotives given on this page. Please note that the catalogue price of the new Hornby Locomotive you purchase *must not be less than double the Part Exchange allowance made for your old Locomotive.*

No matter what the age or condition of your old Locomotive, you can exchange it under our "Part Exchange" plan. It is important to note that we cannot accept more than one old Locomotive in exchange for a new Locomotive.

If you decide to send your old Locomotive to us address your parcel to "Special Service Department, Meccano Limited, Binns Road, Liverpool 13, and be sure to enclose with it your own name and address written in plain characters.

Part Exchange Allowances for Hornby Locomotives

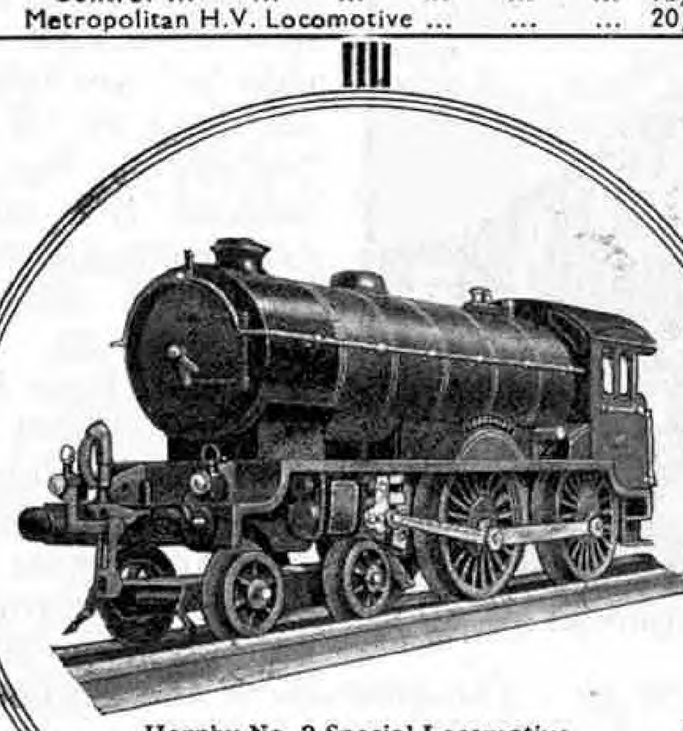
CURRENT TYPES	
M0 Locomotive	1/4
M1/2 Locomotive	2/3
M3 Tank Locomotive	3/9
No. 0 Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/–
OBSOLETE TYPES	
M2930 Locomotive	1/–
George V Locomotive (These models were identical)	3/3
No. 00 Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan H.V. Locomotive	20/–

What you have to do

Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose one of the new Locomotives, the cost of which is not less than 12/6 (or, in other words, not less than double the Part Exchange allowance we make for your No. 1 Tank Locomotive).

You decide, say, to have a No. 2 Special Tank, the price of which is 25/–. Pack up your old No. 1 Tank and deduct 6/3 from 25/– (the price of the new No. 2 Special Tank) enclose a remittance for 18/9 plus 1/– carriage on the new Locomotive—19/9 in all. Send the Locomotive and the remittance to Meccano Limited, Liverpool 13.

Alternatively, you can take your old No. 1 Tank Locomotive to your dealer with a remittance for 18/9, and he will give you the new No. 2 Special Tank Locomotive that you require.



Hornby No. 2 Special Locomotive

HORNBY TRAINS

Manufactured by

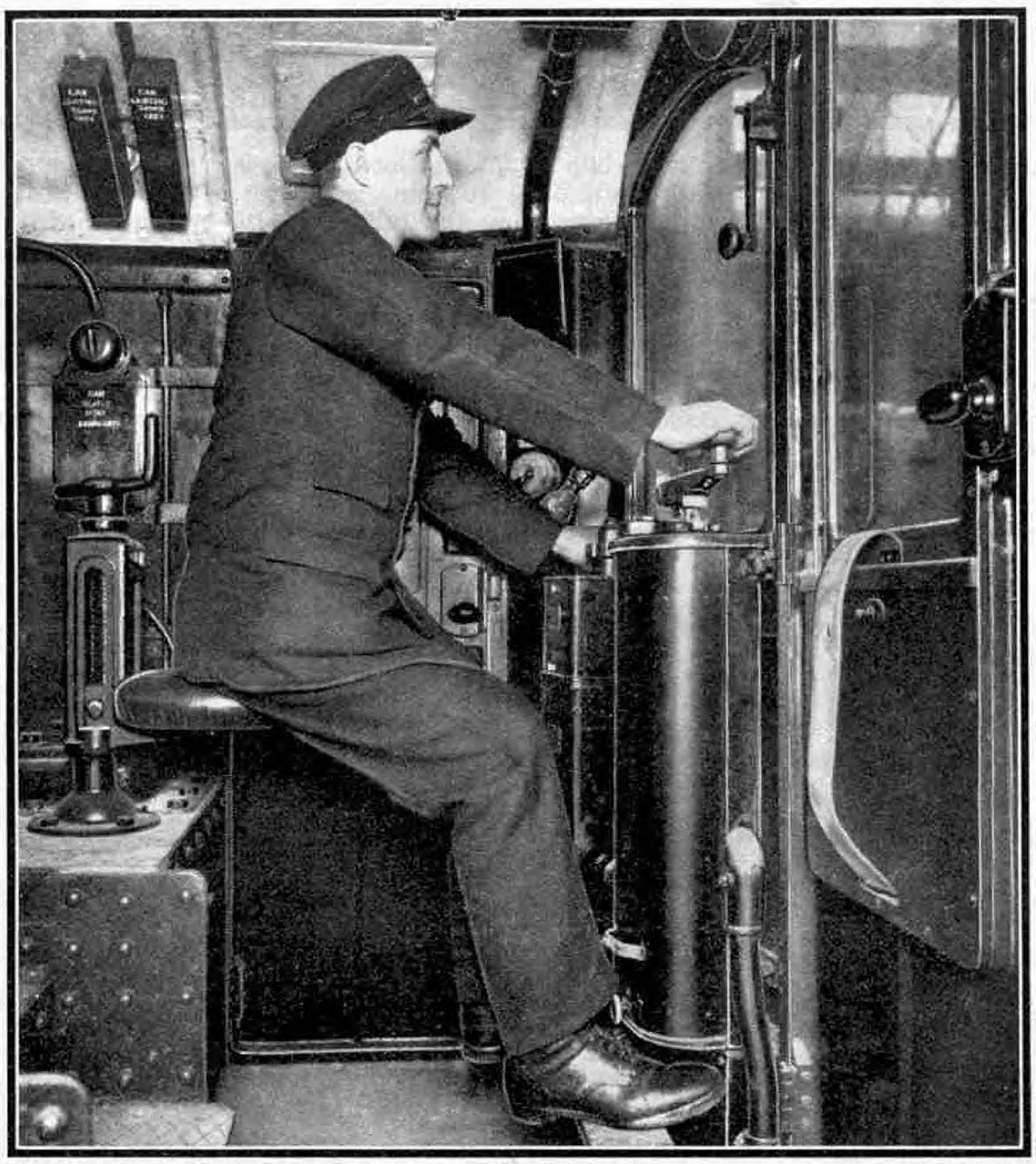
MECCANO LTD., BINNS ROAD, LIVERPOOL 13

the others. The stairways of the escalators have the treads alternately light and dark in colour to guard passengers against the possibility of missing a step.

The platforms at the tunnel stations have been planned to deal expeditiously with even the heaviest traffic. At Manor House, Turnpike Lane and Wood Green the tunnels are 23 ft. 2½ in. in diameter to permit of specially wide platforms. Another innovation is that the platform walls are built on a series of arches that give intercommunication between the underside of the platform and a trough that extends along the middle of the track. This feature allows the staff to go underneath a train while it is standing in a station, and it also facilitates the removal of obstructions.

A distinction that has marked the Piccadilly Tube from the first is that of having different colour-schemes for the tilework at the stations, and this has been continued in the tiling of the platform tunnels at the new stations. The groundwork of the tiling is cream in all cases, the station distinctions being made in the colours of special bands, borders and mouldings. Thus at Manor House these are blue; at Turnpike Lane, yellow; at Wood Green, green and cream in alternate stripes; and at Bounds Green, red. In addition to the artistic effect, these distinctive colourings enable regular passengers to recognise their own station more readily.

Much thought has been given to the lighting of the stations and some novel methods have been employed. The aim has been to provide a softly diffused illumination that gives high visibility without glare. The booking halls are lighted indirectly, the light from floodlights, either on the top of the booking booths or in bronze floor-standards, being reflected downward from the ceilings. Platforms, subways and passages are all effectively lighted and the pressed-glass fittings used have a pleasing appearance.



The driving compartment of an "Underground" train. If the motorman releases his hold on the controller or "dead man's handle" current is automatically cut off and the brakes are applied.

The signalling installed on the extension is all automatic, the signals being controlled by track circuits. They are of the colour-light type throughout, with small lenses suitable for the darkness of the tunnel sections, and daylight signals for the open section at Arnos Grove. All signals are provided with trainstops that actuate the tripcock on the train and automatically apply the brakes if the driver does not stop when the signal is at danger. Two signal cabins are provided on the new section, one at Wood Green to permit the reversing of trains at this point, and one at Arnos Grove for the reversing of trains and working the connections to sidings. I visited the one at Wood Green and watched its working. It is, of course, underground, and in his cabin with the door shut the signalman sees neither the signals or the passing trains, but nevertheless he is fully aware of all that is happening. Before him is a large illuminated diagram showing clearly all the sections under his control. He can see the position of each train, whether in the siding or on the running lines, and can mark the progress of each; and the setting of the points and the lighting of the signals are all shown plainly in the apparatus before him. An elaborate system of interlocking makes it practically impossible for him to make a mistake.

Provision has been made also for the signals and points from this cabin to be worked automatically without the need of a signalman. In order to do this, the train describer apparatus, which normally informs the signalman of the destination of the train, can be connected up to the signal apparatus. Thus, instead of merely telling the signalman where the train is to go, the train describer apparatus itself sets the points and clears the correct signals for the route to agree with the train's destination. This is an exceedingly clever arrangement, and for eastbound trains is operated by the signalman at Hammersmith and for westbound trains by the signalman at Arnos Grove.

The remainder of the new extension is in an advanced stage of construction and will be opened during the first half of this year. Beyond Arnos Grove the line comprises a viaduct and a ½-mile twin-tunnel, in which Southgate station is situated. From this tunnel the line rises in a cutting a short distance north of Southgate station, and is thence carried by viaduct and embankment and cutting to the terminus at Cockfosters. I motored to Cockfosters and noted the works proceeding there. Tracing the course of the line, I could see, rather less than a mile away, the buildings in course of erection for the new station at Enfield West. I surveyed the country all around, and in imagination saw something of the transformation that will soon be wrought as the magic of the Tube claims it for ever-growing London.

In February last the Prince of Wales visited the extension, with the special object of inspecting the latest type of electric traction equipment, which is entirely of British design and manufacture. The Prince drove one of the newest trains on the Southgate extension, and inspected a typical mercury arc rectifier substation and control room. The mercury arc rectifier equipments—including switchgear, high-speed circuit breakers and control apparatus—on the northern extension have been manufactured by the British Thomson-Houston Co. Ltd., and those for the western section by the General Electric Co. Ltd.

The average distance between substations is approximately two miles. These substations are completely automatic in operation, the starting and stopping of the rectifiers being achieved from the central control rooms at Wood Green and Alperton. The incoming alternating current supply at 11,000 volts is converted by the mercury arc rectifier equipments to 630 volts direct current for the track, filter circuits being provided to ensure non-interference with telephone communication. The London Electric Railway Company, at the present time the most extensive user of rectifiers in Great Britain, was the first railway company in this country to use the mercury arc method of converting current for heavy suburban traction purposes. The first plant of this kind to be manufactured in Great Britain was designed and built by the British Thomson-Houston Co. Ltd., at Rugby, and installed in 1930 at the Hendon underground substation.

Several new features are incorporated in the design of the trains required as a result of the increased route and growing traffic. The 145 new motor coaches are fitted with G.E.C. Witton traction motors, and with electric control equipments manufactured by the B.T.H. Co. Following standard practice, a train consisting of one or more motor coaches and a number of trailer coaches can be driven by one man from either end of the train.

The "master controller" at each driving point is fitted with a "dead man's handle" designed so that removal of the pressure of the driver's hand, from any cause, instantly cuts off the power supply and causes the brakes to be applied. This feature was first introduced many years ago by the B.T.H. Co., notably in 1900 on the Central London Railway System which is now incorporated with the London Electric Railway.

As we go to press, we learn that the Enfield West extension was opened on 13th March.—Editor.



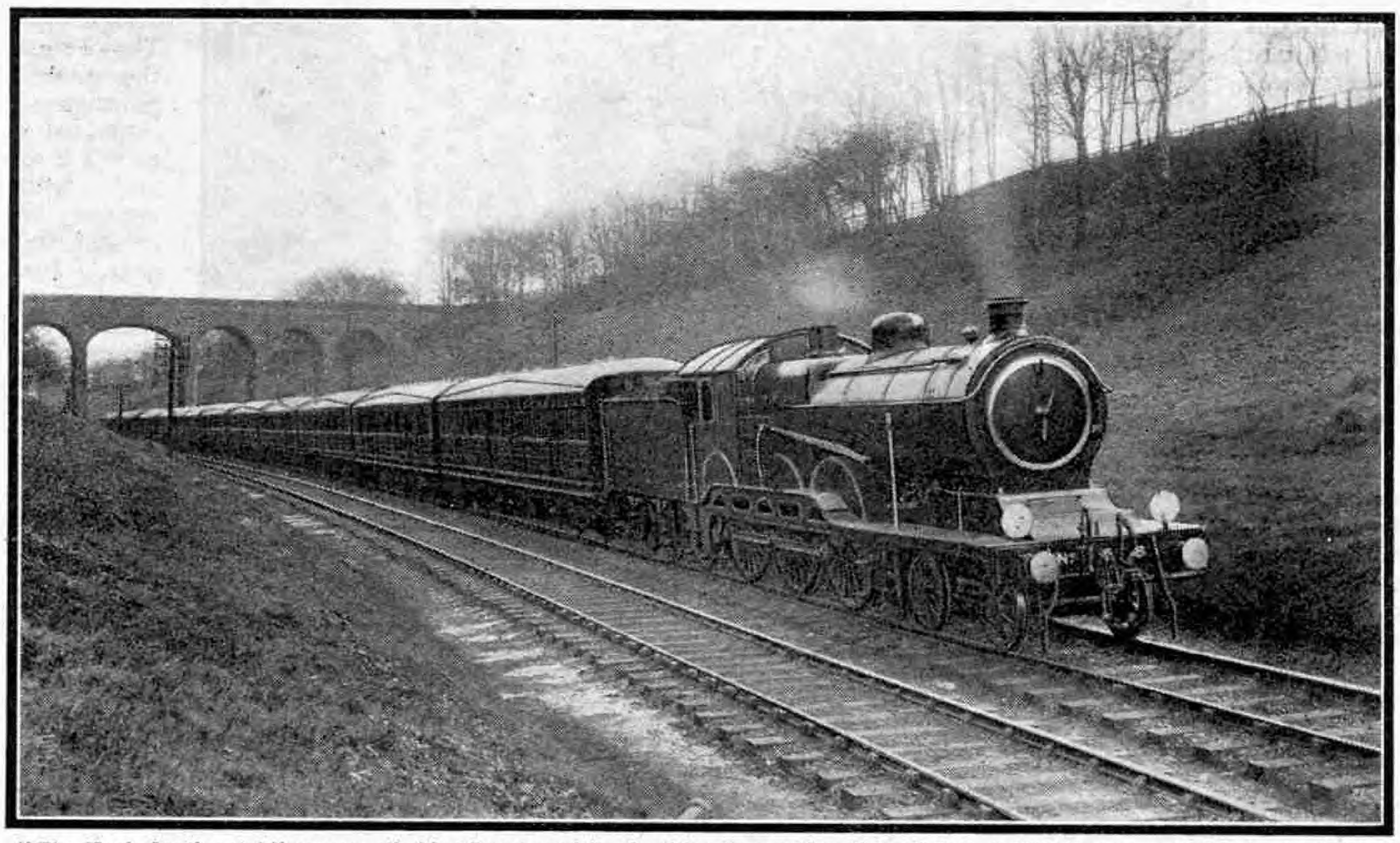
Diesel-Electric Express on the L.M.S.R.

Diesel-electric traction made a decided advance in Great Britain in the successful running of the "*Armstrong-Shell Express*" on the L.M.S.R. between London (Euston) and Birmingham (Castle Bromwich) during the British Industries Fair from 20th February to 3rd March. For this service one of the Armstrong-Whitworth 250 h.p. oil-electric railcars, "*The Northumbrian*," had been specially adapted and fitted with luxurious arm-chair seats in Pullman style. These occupied two saloons—four in one and eight in the other—and in addition kitchen, pantry, wardrobe and lavatory compartments were provided. On each side of the car the name "*Armstrong - Shell Express*" was painted in bold letters.

One or two trial runs were made previously, and then throughout the Fair a regular week-day service was maintained. Euston was left each morning at 11.35, and the run of 112.9 miles thence to Birmingham (New Street) was made non-stop in 2 hr. 6 min. After a stop of 6 min. the car proceeded to the Armstrong-Shell Station at Castle Bromwich, arriving at 2.3 p.m. On the return journey, Castle Bromwich was left at 4.43 p.m. and New Street at 5.3 p.m., Euston being reached at 7.15 p.m.

The schedules were excellently sustained and the running of the car at all speeds was notably smooth and steady. The weather conditions during the first week were extremely unfavourable—quite the worst of the past winter—but even on Friday, 24th February, when a blizzard swept the country, the express kept time from London to Birmingham with a fuel consumption of 20 gallons, costing less than six shillings. On the return journey that day, when traffic dislocation was somewhat bad, only 10 min. were lost. On another severe day the railcar on its return journey kept time as far as Rugby in spite of a strong wind and heavy snow. Signal delays later made it 6 min. late in passing Bletchley, but Euston was reached only 2 min. late. From a signal stop at Blisworth, the 62.8 miles to Euston were done in 67½ min.; while for the 15 miles from Bletchley to Tring—mostly uphill—barely 14½ min. were taken, showing an average speed of 63 m.p.h.

In this interesting series of runs the aim was to demonstrate to the British public the possibilities of Diesel-electric railway traction and at the same time to convince railway authorities throughout the world that British industry can provide Diesel-electric railway units of the highest class for overseas markets. The promoters are to be congratulated on the success that the "*Armstrong-Shell Express*" undoubtedly achieved.



"The Hook Continental" express climbing Brentwood Bank with a locomotive of the G.E.R. "1500" class at its head. Engines of this class had almost exclusive charge of the Harwich Boat Trains until the coming of the L.N.E.R. "Sandringhams." Photograph by courtesy of the L.N.E.R.

"*The Royal Scot*" for America

The L.M.S.R. are sending their famous "*Royal Scot*" express to America, for exhibition at the Chicago World's Fair that opens on 1st June.

Prior to its display on tracks adjoining the Travel and Transport Building of the Fair, and again at the close of the Exhibition, arrangements have been made for "*The Royal Scot*" to make extensive tours of the North American Continent, visiting the principal cities and towns both in the U.S.A. and Canada. At each place the train will be placed on exhibition, and invitations will be extended to prominent citizens to inspect it.

This will be the first occasion on which a complete British train has visited America. In 1893 an engine named "*Queen Empress*," one of Mr. F. W. Webb's compounds, and two passenger coaches were sent by the L.N.W.R., now part of the L.M.S.R., to the World's Columbia Exposition held in Chicago in that year. Now, just 40 years later, the "*Royal Scot*," descendant of the "*Queen Empress*" and with a tradition almost as old as the railway industry itself, is going to demonstrate to her cousins across the Atlantic the striking progress and development that have taken place in British locomotive and train construction.

The engine chosen to make the trip is No. 6100, "*Royal Scot*," precursor of 70 locomotives of the same type that rank at present as the most powerful passenger express engines on the L.M.S.R. system.

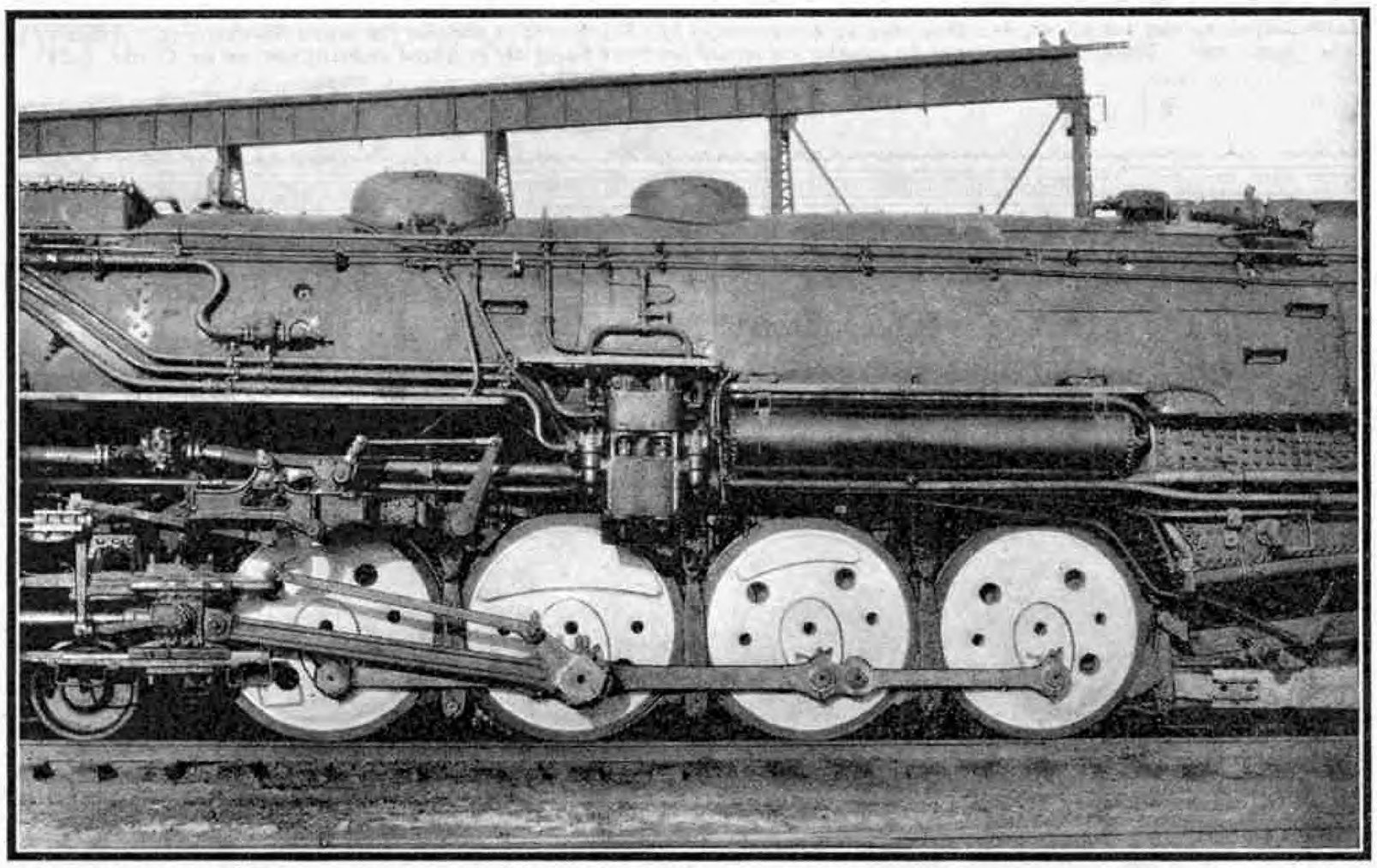
The train itself will be composed of eight of the most modern type vehicles. These are third-class corridor brake, third-class vestibule coach, electric kitchen car, first-class corridor vestibule coach, lounge car, third-class sleeping car, first-class sleeping car and first-class corridor brake.

Highland Engine to be Preserved

The L.M.S.R. have decided to preserve one of the "Jones Goods" locomotives of the former Highland Railway. These engines, introduced in 1894, were the first 4–6–0s in British railway service.

Whitemoor Marshalling Yard Extension

The new down marshalling yard on the L.N.E.R. at Whitemoor, near March, in Cambridgeshire, is now in operation. The up yard was opened four years ago, and has abundantly proved its ability to deal expeditiously with a great volume of freight traffic. Some improvements have been effected in the new down yard, the most interesting being the installation of two "eddy current" rail brakes for retarding the wagons after they have passed over the hump. By means of electro-magnetic power these brakes can bring a cut of four wagons, travelling at 16 m.p.h., to a standstill in a few seconds without any jerking or fear of derailment. The working of the new brakes and of the whole yard will be watched with keen interest. This wonderful mechanised marshalling yard is now the largest of its kind in Europe. There is, indeed, but one bigger in the world, that at Markham, on the Illinois Central Railway in the United States.



Disc driving wheels for locomotives! Each driving wheel of the New York Central Railroad locomotive shown in our illustration consists of a double disc centre with an ordinary locomotive tyre round it, and is lighter than a spoked wheel of the same size. Wheels of this kind also may be cast more easily than those of the usual type.

Building and Scrapping on the G.W.R.

The batch of 2-6-2 tank engines numbered 6150-9 have been completed at Swindon and the new series of 0–4–2 tank engines are now nearing completion. The repair shops are especially busy, and many "Castles" and "Kings" are being overhauled and put into perfect trim for the heavy traffic of the approaching holiday season. Several of the latest "Castles" are being fitted with felt pads in place of the usual worsted trimmings for lubricating the axle boxes.

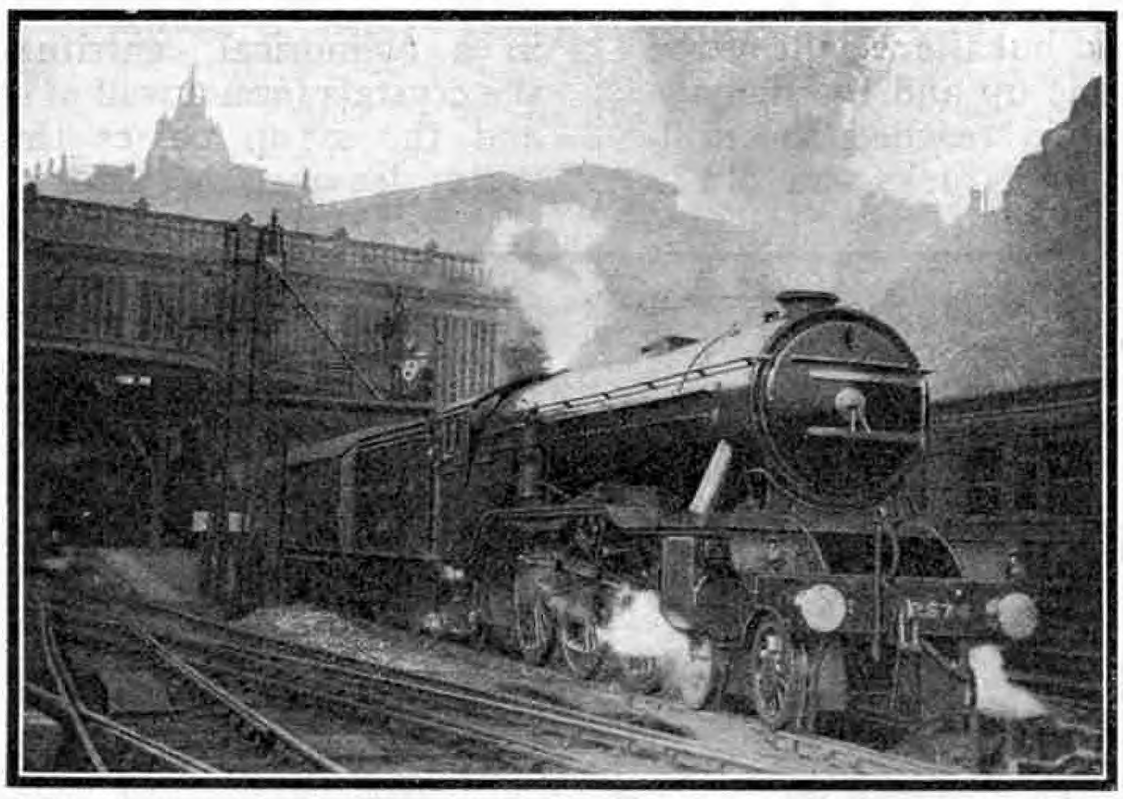
During 1932 no less than 192 G.W.R. locomotives were withdrawn for scrapping. Included among them were six 4–6–0 express engines of the "Saint" and "Star" classes. Most of the condemned, however, were tank engines of various types, and not a few were engines that had belonged formerly to the Cambrian, Barry and other Welsh railways now incorporated in the G.W.R. Such wholesale scrapping may seem a somewhat drastic policy, but it makes for standardisation and ultimate economy.

An extensive wagon-building programme to be undertaken will include the production of no fewer than 1,250 vehicles of the latest designs. Of these 500 will be open and 750 will be covered wagons, 500 of the latter being fitted with automatic brakes. All of them will have oil axle-boxes.

L.M.S.R. Locomotive News

In addition to the new 4–6–0 locomotives of the "Baby Scot" class now building at Crewe, an order for 10 of the same class has been put in hand at Derby. Four 2–6–0 "Mogul" tender engines are being built at Crewe for service on the lines of the Northern Counties Committee in Ireland.

Several changes in L.M.S.R. practice are being carried out by Mr. W. A. Stanier. Included among them is the abolition of the use of by-pass valves on locomotive cylinders. Those already fitted with these valves are having them removed as they visit the repair shops. Several "Royal Scots" have already had them removed. Another change is that brakes are no longer to be fitted on locomotive bogie wheels. It may be recalled that the first lot of "Castle" class engines on the G.W.R. had brakes on the bogie wheels, but these were soon removed and no further engines received them.



A London express leaving Waverley Station, Edinburgh. The engine is No. 2576, "The White Knight," and as it is employed in the North Eastern and Scottish areas, it carries a Westinghouse brake pump on the right-hand side, as shown in our illustration. Photograph by courtesy of the L.N.E.R.

New "Sandringhams" on the L.N.E.R.

Steady progress has been made at Darlington works on the new lot of 3-cylinder 4–6–0 express locomotives of the "Sandringham" class. The first of them is now in traffic and is numbered and named 2837, "*Thorpe Hall.*" Engines of this class have lately been taking a share in working expresses on the Great Central section between London (Marylebone), Leicester, Nottingham and the North.

Another of the 4–4–4 tank engines of the former N.E.R., No. 1528, has been reconstructed as a 4–6–2, similar to No. 2162.

S.R. "Schools" Class Locomotives

Five of the new 4–4–0 "Schools" class locomotives have been completed at Eastleigh and are numbered and named as follows:—910, "*Merchant Taylors*"; 911, "*Dover*"; 912, "*Downside*"; 913, "*Christ's Hospital*"; and 914, "*Eastbourne.*" Engine No. 911, "*Dover,*" was placed on exhibition for two days at Dover Town Station in order that boys from Dover College and members of the general public might have the opportunity of inspecting it. Further "Schools" engines are similarly to be placed on exhibition.

Milk Traffic Record on S.R.

For the first time on record the Southern Railway have dealt with over a million gallons of milk at Vauxhall in one month. This was in January of this year, and undoubtedly the steady increase has been due to the popularity among the large dairy firms of the bulk transport of milk in the new rail containers.

With the six new glass-lined tank trucks recently completed at their Lancing Works, the S.R. have now 25 of these vehicles in daily use, many of which are of the road-rail type fitted with rubber-tyred road wheels.

The six new wagons, which have been delivered to the order of the United Dairies Ltd., are six-wheeled trucks of the most up-to-date construction fitted with vacuum brakes. They are attached to passenger or express milk trains, and bring the daily supplies from Somerset and Wiltshire to the firm's depot at Vauxhall.

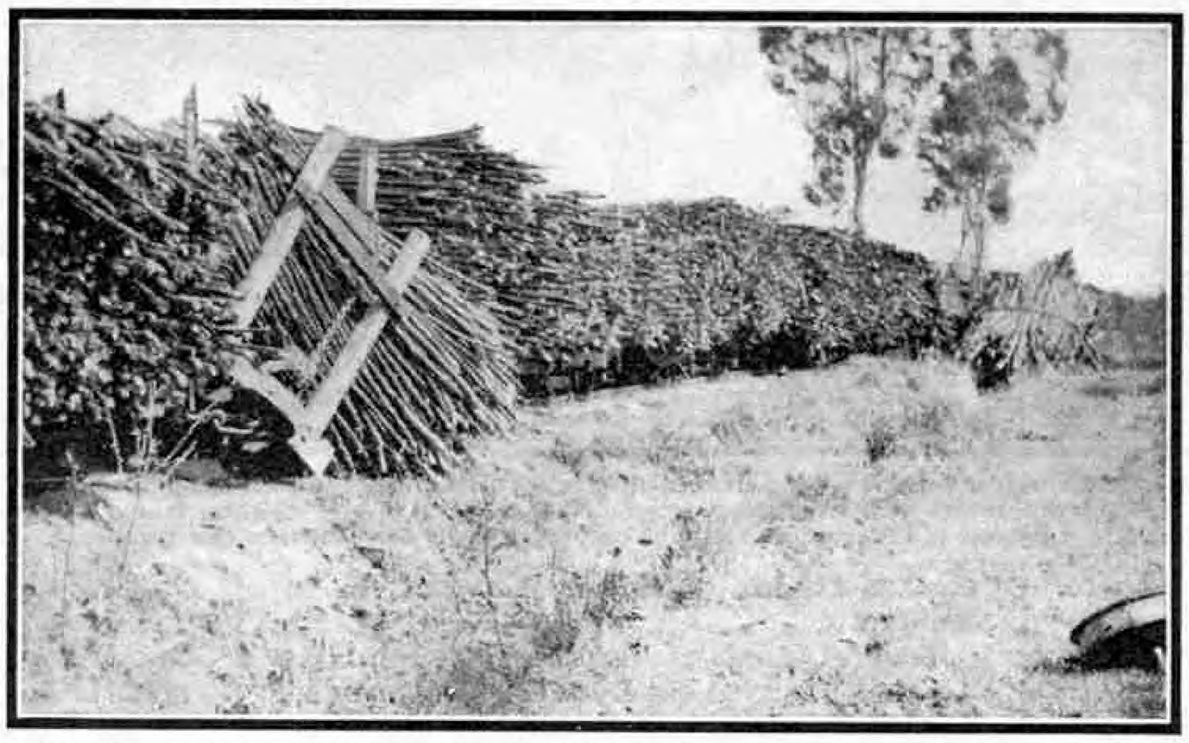
Each vehicle will hold 3,000 gallons of milk, and as this quantity would require anything up to 300 milk cans, one of these new type containers will displace at least three of the old railway milk vans.

FROM OUR READERS

These pages are reserved or articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

In an Australian Sugar Mill

I served my apprenticeship as a fitter at the Racecourse Sugar Mill, Mackay, Queensland, and had previously worked on the narrow gauge locomotives that haul trucks of sugar cane from the fields to the crushing plant. The accompanying photograph shows part of a sugar train that was brought to a standstill by the breaking of an axle of one of the heavily-laden trucks, the broken part being visible in the lower right-hand corner of the illustration. The locomotive was travelling at about 8 m.p.h. and 28 trucks were derailed.



Australian sugar cane on the way from the fields to the crushing plant. One truck has been derailed by the breaking of an axle. Photograph by G. McCubbon, Queensland.

When an accident occurs on this narrow gauge line the trucks usually are thrown about violently owing to the large clearance between their buffers. On one occasion an axle broke when a train was near the scene of the accident shown in the illustration, but the weight of the trucks behind kept the broken one up and the damage was not discovered until the train reached the mill. The driver of a return train of empty trucks was told to look out for the broken part. As it was getting dark he did not see it, but he found it just the same, for the cow-catcher on the tender struck the end of the axle. The tender itself capsized and the 50 empty trucks behind it were very quickly telescoped into the space ordinarily occupied by 20 trucks.

On arrival at the mill the sugar cane is cut up by revolving knives and crushed between gigantic rollers weighing 11 tons each. The three crushing mills at Racecourse are driven by engines developing about 160 h.p. at 45 r.p.m. These are geared down in the ratio of 24 to 1, and thus the rollers of the crushing plant make about 2 r.p.m. The steam pressure is 90 lb. per sq. in., and the engine cylinders are 26 in. in diameter and have a stroke of 48 in. Tail rods are fitted in order to eliminate wear on the bottom of the cylinders, and the weight of the flywheel is 11 tons.

The plant is kept very busy during the crushing season, and I quickly realised that this means hard work for the engineering staff, who are allowed little time for necessary adjustments or repairs.

The juice crushed out of the sugar cane is clarified by means of milk of lime, with which it is mixed before being pumped through tubes heated by exhaust steam into a baffle tank, and thence into a subsider, where impurities are allowed to settle out. A further clarification with lime follows, and finally the juice is evaporated in "trips," or vacuum pans, until it is syrupy. It is then pumped into a tank until it can be passed to other vacuum pans in which it is further evaporated to crystallising point.

Separating the crystals of sugar from the liquor in which they are produced is a very interesting process, for they are whirled round at a speed of nearly 1,000 r.p.m. in a cylindrical centrifuge of copper gauze. There the crystals form a wall of sugar about 6 in. in thickness, and the syrup passes through the gauze and flows away, leaving the grains of sugar behind. A little hot water is thrown on the crystals and sometimes high-pressure steam is turned on them. The friction clutch that drives the centrifuge is then slipped and the brakes are applied. These brakes are necessary, for the cylinder is so nicely balanced that if left to itself it would continue to rotate for hours. The sugar drops on to a screw conveyor below the open end of the centrifuge, for when this is not being whirled round at great speed, the crystals are no longer forced against the walls of the copper gauze, and is then ready for drying.



A typical Russian droski. This photograph and those on the opposite page are by J. Moryson, Cricklewood, N.W.2.

The liquid that passes through the screen of the centrifuge is again evaporated in order to enable more crystals to be obtained from it, and this process is continued until only molasses is left, from which no more sugar can be crystallised. G. McCubbon (Mackay, Queensland).

A Visit to Leningrad

In August 1929 I was a passenger in the first British tourist liner to enter a Russian harbour since the Revolution. As the vessel approached Leningrad we could see the domed roofs of the churches in the city while at a considerable distance, and eventually we passed between jetties about two miles in length and moored alongside a small wharf in the mouth of the River Neva.

On landing we entered a shed, where our passports were closely scrutinised, and then crossed several raised railway tracks in order to reach a cobbled road on which stood five omnibuses and several American cars. The omnibuses were painted yellow and brown, their colours reminding us of the coaches of the G.W.R., and we took our places in them in order to be driven to the dock gates, about a mile and a half away. On the way we passed enormous stacks of timber among which worked men stripped to the waist. Beyond the stacks could be seen the masts and funnels of vessels in the harbour, while up and down the river passed busy tugs hauling barges laden with wood from the immense Russian forests.



The Summer Palace of the former Tsars of Russia.

In Leningrad I quickly remarked the absence of motor cars. During the whole of my visit I only saw one private car, and this belonged to a State official. Tramcars were the chief means of transport. These were noisy four-wheeled single deckers with trailers on which crowds of passengers travelled, those who were unable to find room inside clinging to any available projection on the outside. There were no taxis, of course, droskis or horse-drawn carriages seating four people being used instead.



The statue of Peter the Great, Leningrad, with the cathedral of St. Isaac in the background.

With other members of the party I visited the Summer Palace of the Emperors. This is situated at a distance of 20 miles from the city and the outward journey was made in omnibuses, over terribly bad roads that in places were a foot deep in mud. It is impossible to give a complete description of the magnificence of this Palace and its contents, but I noted particularly a small motor car formerly used in the building itself by the son of the late Emperor, Nicholas II. The boy was known as the Tsarovitch and suffered from ill-health. His car was electrically driven and its bodywork was made entirely of aluminium.

Our return to Leningrad began badly, for three of the omnibuses broke down and one caught fire! The accident had its fortunate side, however, for it enabled me to travel in a Russian train, as we were taken to the city by rail. The carriages of our train were built entirely of wood, and the seats were not upholstered and were extremely hard. The locomotive had a smoke stack a yard in height, and at the top of this was a wide bonnet to arrest sparks, for the fuel was wood, which is very cheap in Russia. In spite of the discomfort the journey was interesting, and I was sorry when at last it came to an end, and we ran into Leningrad Station, which seemed to me to be nearly as large as Waterloo.

J. Moryson (Cricklewood, N.W.2).

Making Steel Shafts for Golf Clubs

The introduction of steel shafts for golf clubs may be said to have created a new industry, and recently I was given the opportunity of seeing shafts of this kind made. The raw material is steel tubing, which is straightened and cut to convenient lengths, the pieces then being softened by heating in order that they may be given their necessary shape. They may be tapered in steps, this process being carried out on a machine that deals with 17 shafts at once, or their diameters may be made to decrease gradually. The two kinds of clubs thus formed are known as step-down and straight-tapered respectively.

At this stage the shafts are still soft and would be useless for golf clubs. In order to make them tough and flexible, they are first hardened by heating and quickly immersing in oil, and then tempered by reheating to a slightly lower temperature and cooling slowly. Electric furnaces are used in these operations, for the temperature of these can be very accurately regulated. The slightest error in the tempering process would render the shafts useless in service and an exhaustive series of tests therefore is carried out in order to ensure that every one sold is of the required standard.

Every shaft produced is forcibly bent and is not regarded as satisfactory unless it becomes perfectly straight when released. Splits, dents and other defects are detected by slamming the shafts on a wooden surface, for this has the effect of opening out cracks and revealing hidden defects. A shaft that survives these tests, and rings true when allowed to fall on a flat steel surface, is strong and possesses the necessary whip to enable good shots to be made with it. If the slightest dullness is detected in the sound made by any shaft tested in this manner, the shaft is discarded and afterwards carefully examined in order to discover the defect.

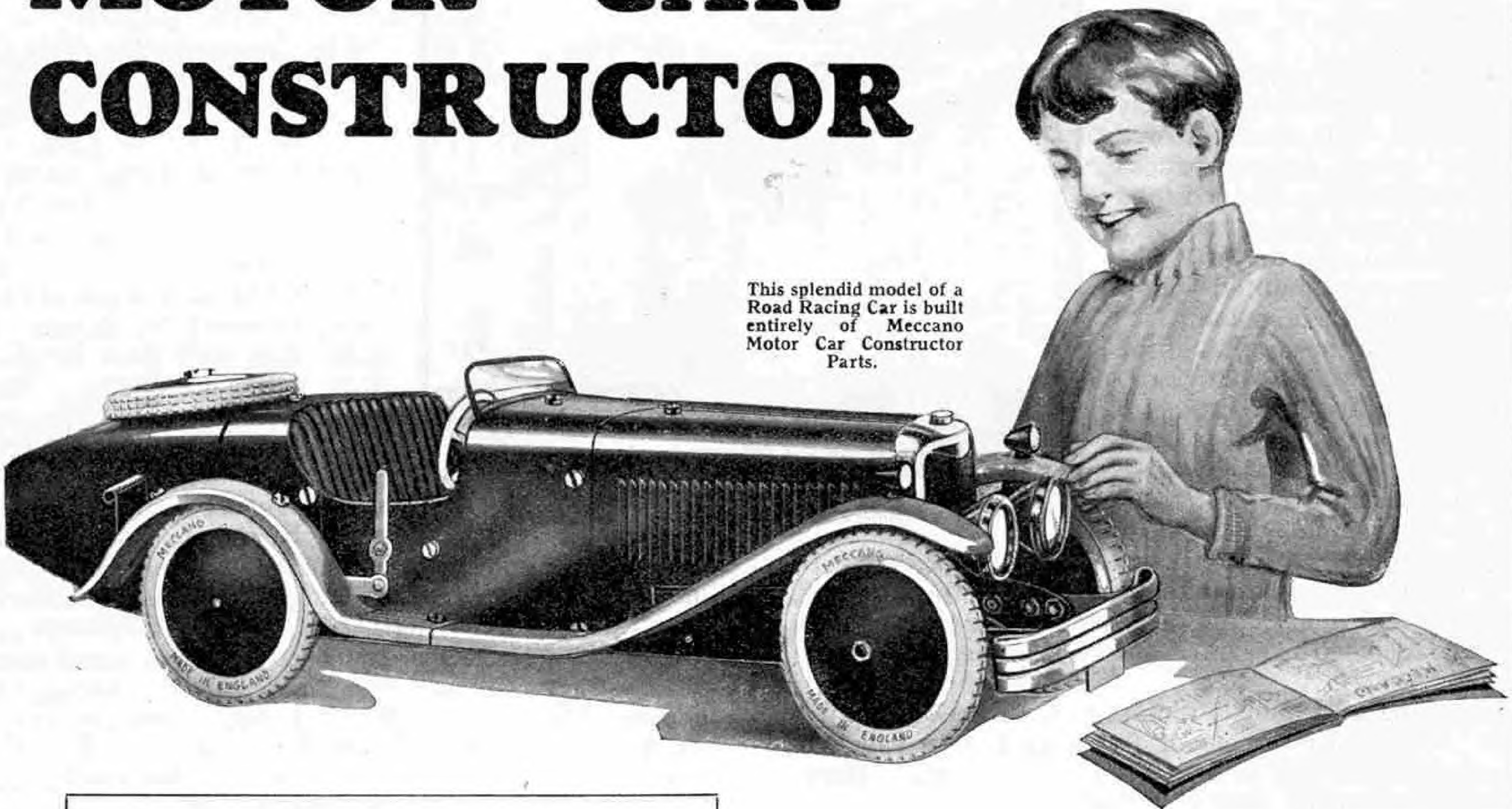
The shaft is now ready for the final processes, which may take one of several forms. It may be finished either by polishing, plating or spraying, and is then ready to be given a suitable head.

When looking at a pile of finished shafts I was told that no fewer than 80 operations are carried out in the factory.

H. Neesham (West Hartlepool).

MECCANO

MOTOR CAR CONSTRUCTOR



This splendid model of a Road Racing Car is built entirely of Meccano Motor Car Constructor Parts.



SPECIAL FEATURES OF MECCANO MOTOR CAR CONSTRUCTOR MODELS

High power Drive

Ackermann Steering Gear

Internal-expanding rear wheel brakes

Solid die-cast wheels fitted with rubber tyres

Chromium-plated lamps, radiator and bumper

The most attractive toy ever produced

Every boy who is keen on building models will want this splendid Motor Car Constructor Outfit. It is the latest Meccano development and the most attractive toy ever produced.

With it you can build models of sports and speed cars, each strikingly realistic and a masterpiece of design and workmanship. An extremely powerful clockwork motor is included giving the models a run of 150 feet on one winding. All the parts contained in the Outfit are sturdily made and beautifully finished in rich colours. The Outfit is available in four different colour combinations as follows: Red and Light Blue, Light Blue and Cream, Green and Yellow, Cream and Red.

Price 25/-

MECCANO LIMITED
Binns Road, Liverpool 13

Trevithick—(*Continued from page 253*)

Trevithick's first blast pipe, or a copy of it. There is no doubt that Trevithick deliberately employed the pipe to provide a good blast, and not merely to get rid of waste steam in a convenient manner, for in a letter to a friend he wrote: "The fire burns much better when the steam goes up the chimney than when the engine is idle."

The engine in working order weighed about five tons. Its boiler was of wrought iron, and steam was raised at a pressure of about 40 lb. per sq. in. The single cylinder employed was placed centrally in front of the boiler, with the chimney on its right, and had a diameter of 8½ in. and a stroke of 4½ ft. The crosshead ran on guides and drove gear wheels on each side of the engine by means of long connecting rods and cranks. A train of gears drove the four wheels of the locomotive, all of which were driving wheels, and thus they were coupled together, although not by side rods as in modern locomotives. This coupling was the second feature of modern locomotive practice that was included in this pioneer engine.

It is interesting to note that Trevithick deliberately ran his engine on smooth rails instead of wasting time on unnecessary experiments with toothed rails, as did other pioneer locomotive designers, who could not be convinced that ordinary wheels would give sufficient adhesion. Trevithick had satisfied himself on this point by means of trials on the hills of his native county of Cornwall.

Trevithick's engine was the first successful steam locomotive ever constructed and was a triumph for his system of employing high-pressure steam. Engineers from all parts of the country travelled to Pen-y-Darran in order to see it work, and it is said that James Watt and his partner, Boulton, in great alarm, tried to get an act of Parliament passed to prevent the construction of engines of the type introduced by Trevithick on the ground that "the lives of the public are endangered."

The Pen-y-Darran locomotive commenced work in 1804 and was still in working order in the following July. Unfortunately it was too heavy for the cast iron plates on which it ran, and on one fateful journey it broke so many plates that it ran off the road. It was hauled back to Pen-y-Darran by horses and was never again used as a locomotive, although it continued to work for several years as a stationary engine.

Junior Section—(*Continued from page 305*)

may be loaded into special trains consisting only of Milk Vans, or they may be conveyed as convenient with other luggage carried by ordinary passenger trains. Another set of Railway Accessories, No. 1, has extremely realistic contents in the shape of articles of luggage. These are particularly suitable for conveyance by passenger or special parcels train, but the miniature hamper may be used quite well with other "goods" items, for such hampers are used in large numbers for different purposes in actual practice.

It is difficult to arrange suitable loads for such special-purpose vans as the Refrigerator, Meat, Fish and Banana Vans. However, for the Fish Van miniature boxes may be made for the purpose or may be adapted from the numerous empty containers of different kinds that may be collected by miniature railway owners. The barrels mentioned previously are also suitable. Again, as milk and ordinary ventilated vans are sometimes used for fruit packed in cases and tubs, these same items will do for fruit traffic also. Miniature sides of beef or bunches of bananas are more of a problem, but those keen on detail will no doubt use Plasticine or modelling wax to good purpose and transport the results of their labours in Hornby Refrigerator, Meat or Banana Vans.

We hear a great deal in these days of the competition of motor vehicles against railways. The road haulage of locomotives for export has certainly been accomplished, but railways have for a long time made provision for the carriage of the motor vehicle. The running of whole trains containing motor cars for exhibition at motor shows is regularly arranged for, and there are special facilities for those owners of motor cars who are travelling long distances by train and who require to take their cars with them for use in their holiday district. Probably most readers have miniature motor cars suitable for conveyance in Hornby vans. The No. 2 Luggage Van with its double doors makes up a useful and effective vehicle for this purpose.

"Skybird" Contest Final Result

The final awards in this competition are as follows:—Senior "All In" Cup, with added prize of one guinea, R. H. Gehlcken, Palmers Green, London, N.; special prize, A. S. Hill, Baildon, Yorks. Junior "All In" Cup, G. P. Barless, St. Annes-on-Sea; additional Cup, John Ellis, Tunbridge Wells.

Italian Premier Congratulates "M.M." Reader

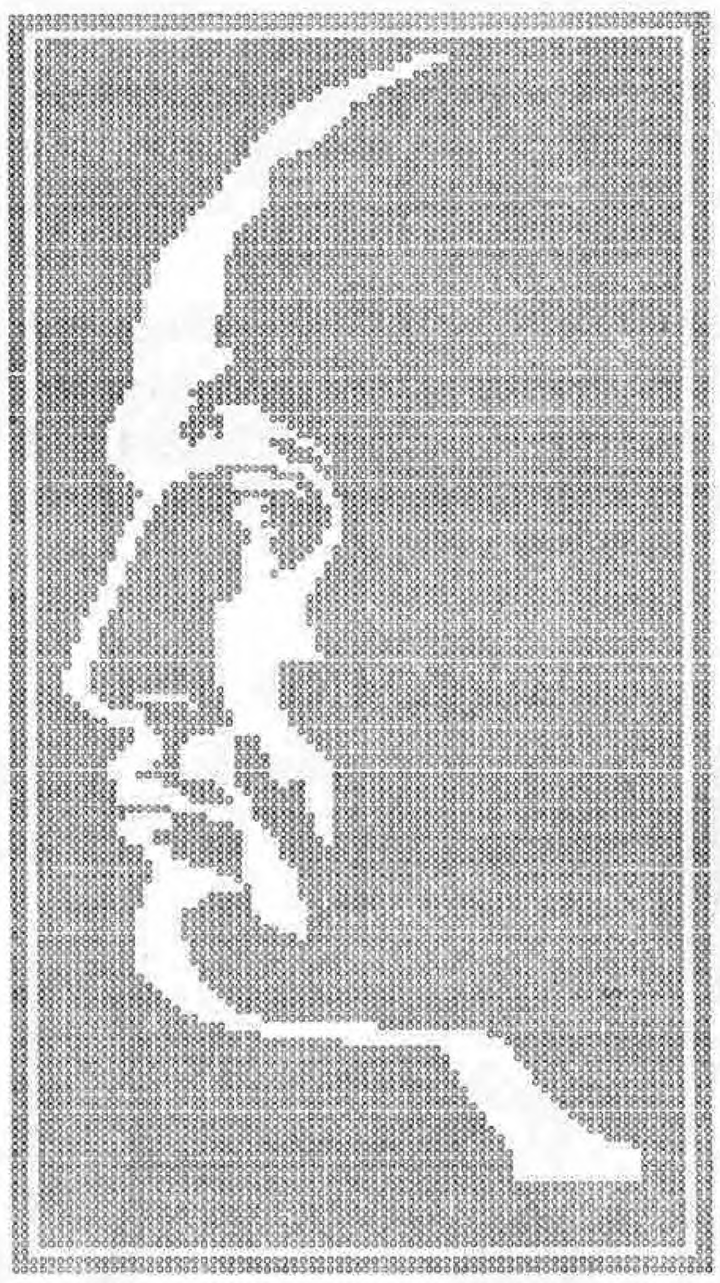
Accepts Typewritten Design Portrait of Himself

In a recent Typewriter Designs Competition the winning entry, a profile portrait of Signor Mussolini, the Italian Premier, showed such excellence of workmanship that we thought it would be of interest to Il Duce himself. We therefore sent the entry to His Excellency, explaining the circumstances in which it came to be executed.

We feel sure that readers will be interested in the following acknowledgment sent to the Editor of the "*M.M.*" by the Royal Consul General for Italy:—

"I am directed by the Italian Premier, His Excellency BENITO MUSSOLINI, to acknowledge the receipt of Mr. Weight's drawing representing H.E.'s profile, and which has won the prize in a competition promoted by your firm for typewritten drawings.

"I am charged by H.E. the Italian Premier to tender you sincerest thanks for the kind gesture, and to congratulate Mr. N. Weight on his cleverness."



Meccano Exhibition in Wallasey

The programme of the second Hobbies Exhibition of the Grammar School, Wallasey, held on 11th February, included an excellent display of Meccano models. First prize in the Meccano section was won by P. J. Drinkwater, with a neat and accurate Bracket Clock. The second prize was divided between C. W. Bonser, Bucket Excavator, and K. Hughes, Bascule Bridge; and J. W. Knowles was given honourable mention for a Ship Coaler.

All the models entered in this section were well planned and excellently constructed, and it was evident that competitors had given careful thought to the selection of subjects.

The most remarkable exhibit in the Hobbies' Contest was a Spark Transmitter and Receiver that earned the principal award for D. Mann. Messages in Morse Code were broadcast by means of an automatic sender built of Meccano parts, and these were recorded on a Meccano inker at the receiving end. The Transmitter was at work throughout the Exhibition and attracted considerable interest.

The Rome Express—(*Continued from page 259*)

Later this scene was incorporated in the film.

Owing to the effects of artificial lighting, the studio sets had to be coloured differently from their prototypes in order to obtain correct colour tones. The outside of the engine and coaches was painted grey, and the ceilings in the compartments of the coach were pink.

Great interest was taken by the P.L.M. in the production of the film, and an official of the company came over to advise the producers on various technical points. A Wagon-Lits attendant who had served for several years on the express was engaged to act in the film, and all the railway officials who are featured in it are Frenchmen. The "extras" engaged for the crowd scenes were the result of careful selection, as it was essential that some of them could converse in foreign languages; and London was diligently searched for suitable types. The producers received every assistance from the Italian authorities in the photographing of that part of the scenery which is in Italian territory. An instance of their interest in the film was shown by the diverting of an incoming train to another platform where there was sufficient light to enable its arrival to be photographed.

We are indebted to the courtesy of the Gaumont British Picture Corporation Ltd., for much of the information contained in this article.

Model-Building Contest Results

"WINTER" CONTEST (HOME SECTIONS)

Section A

First Prize, Cheque for £3-3s.: G. S. King, London, S.W.17. Second Prize, Meccano or Hornby Train goods value £2-2s.: W. Caton, Liverpool. Third Prize, goods value £1-1s.: E. G. Lewis, Winchcombe, Glos.

Six Prizes of goods value 10/6: J. Gow, Dundee; J. Powell, Manchester; A. Gardiner, Dorchester; E. Salt, Lincoln; E. Bradshaw, Sheffield; R. Read, Portsmouth.

Six Prizes of goods value 5/–: V. Kaile, Mayford; F. Holland, Gravesend; R. Blake, Worcester Park, Surrey; S. Smith, Enfield; G. Bradley, Oldham; F. Margerison, Blackburn.

Six Prizes of "*Famous Trains*" by C. J. Allen: D. Holloway, Squirrels Heath, Essex; L. Kennard, Amersham, Bucks.; C. Williams, Manchester; W. Trenholm, Eaglescliffe, Co. Durham; J. Prosser-French, Tonbridge; B. Simpson, London, S.W.5.

Meccano Engineer's Pocket Books: A. Millar, Timperley; M. Holmes, Baildon, Yorks.; D. Daines, London, N.1; M. McDonald, Dublin; R. Lawford, Bexley Heath, Kent; K. Wells, Newport, I.O.W.; J. Jackson, Bicester, Oxon; C. Kemp, Chandlersford, Hants.; A. Farnell, Buxton; J. Horrox, Lockton, Yorks.; I. Sage, Charing, Kent; H. Newton, Pontefract; C. Wrayford, Newton Abbot.

Section B

First Prize, Cheque for £2-2s.: A. W. Beecroft, Hull. Second Prize, Meccano or Hornby Train goods value £1-1s.: James Bell, Bootle, Liverpool. Third Prize, goods value 10/6: R. Williams, London, S.W.20.

Twelve Prizes of goods value 5/–: A. Broad, London, N.W.6; C. Edmond, Glasgow, W.3; A. Fitch, Blaydon-on-Tyne; G. Jackson, Southend-on-Sea; N. Kent, London, N.5; B. McCullough, Manchester; J. Mapplebeck, Huddersfield; P. Oppermann, Devises, Wilts.; B. Palmer, Oxford; M. Parke, Malton, Yorks.; C. Tidman, Hillingdon, Middx.; A. Sutton, London, S.W.20.

Twelve Meccano Engineer's Pocket Books: T. Milligan, Mauchlin, Ayrshire; R. Bartlett, London, N.12; K. Laidlaw, Reading; G. Parker, Bury St. Edmunds; R. Paton, Symington, Kilmarnock; M. Scott, London, S.W.7; W. Farrar, Leicester; H. Fenton, Blackpool; D. Baker, Ipswich; J. Lock, Shrewsbury; I. Sheldon, Coventry; G. Wright, Chester.

"ARCHITECTURAL" CONTEST

Home Section

First Prize, Cheque for £2-2s.: R. Tydeman, Woodbridge, Suffolk. Second Prize, Meccano or Hornby Train goods value £1-1s.: W. Pegum, Balleylongford, Ireland. Third Prize, goods value 10/6: John Matthews, Fillongley, Coventry.

Six Prizes of goods value 5/–: A. Glossop, Chorley; R. Thomas, London, W.11; P. Baxter, Middlesbrough; L. Fulton, Birmingham; S. Ferguson, East Molesey, Surrey; F. Greenen, Bournemouth.

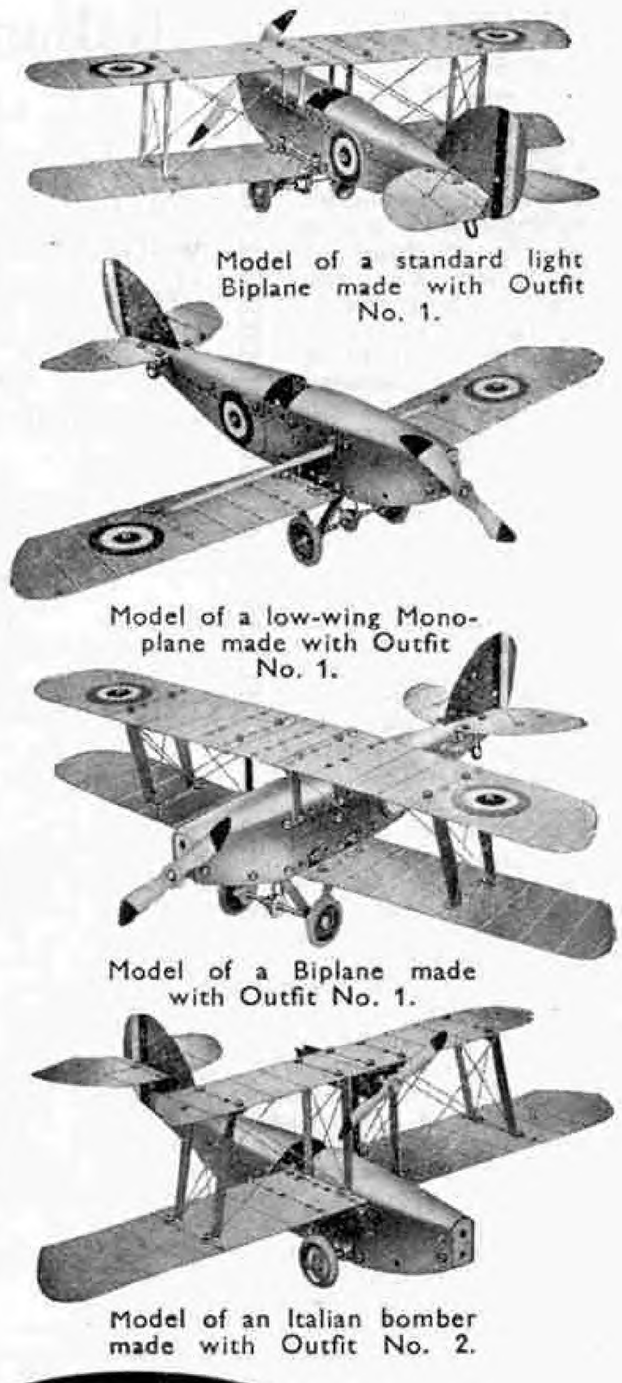
MECCANO

AEROPLANE CONSTRUCTOR OUTFITS

Boys, Build Your Own Model Aeroplanes!

The new Meccano Aeroplane Constructor Outfits afford every boy the thrill of building his own aeroplanes, plus the joy of possession. The parts contained in these Outfits enable aeroplane construction to be carried out on sound engineering lines. They are all interchangeable on the famous Meccano principle. The illustrated Manual of Instructions included in the Outfit shows how to build wonderful models of high and low-wing Monoplanes, Biplanes, Seaplanes and giant amphibian machines; in fact, models of almost every type of aircraft can be made with these splendid Outfits. If you want to know something about aeronautics, buy an Outfit to-day.

Meccano Aeroplane Constructor Outfit No. 0 ... ... Price **5/-**
Meccano Aeroplane Constructor Outfit No. 1 ... ... Price **9/-**
Meccano Aeroplane Constructor Outfit No. 2 ... ... Price **16/6**
A Meccano Accessory Aeroplane Constructor Outfit No. 1A (price **8/6**) converts a No. 1 Outfit into a No. 2.



Model of a standard light Biplane made with Outfit No. 1.

Model of a low-wing Monoplane made with Outfit No. 1.

Model of a Biplane made with Outfit No. 1.

Model of an Italian bomber made with Outfit No. 2.

MECCANO LTD.
BINNS ROAD
LIVERPOOL 13



Meccano Aeroplane Constructor Outfit No. 2. Price **16/6**

Meccano Model-Building Competitions

"Wagon Tippler" Contest

Elsewhere in this issue will be found an article entitled "*High Speed Wagon Tipplers*," in which are described some of the latest devices that have been designed for unloading railway wagons. The various types of tipplers dealt with in this article are illustrated, and it will be seen that their construction and design is simple, while their method of operation is very interesting. Every keen Meccano boy will at once realise that here are splendid subjects for models, for almost every detail of the framework and mechanism of these tipping plants can be readily reproduced in Meccano. We have therefore chosen wagon tipplers as the subject of this month's big competition.

To enter the contest, readers must build a model of any one of the various types of tipplers described in the article referred to. Any size of Outfit may be used, and there are no entry forms to fill in or fees to be paid. The Contest is open to readers of all ages.

Entries will be divided into two Sections as follows. Section A, for competitors of all ages living in the British Isles. Section B, for competitors of all ages living Overseas. A similar and separate set of prizes will be awarded in each Section for the models that the judges consider to most closely resemble the actual machines.

The prizes will be as follows. First, cheque for £3-3s. Second, Meccano goods value £2-2s. Third, goods value £1-1s. Five prizes of goods value 10/6. Five prizes of goods value 5/–. Five prizes of "*Famous Trains*" by C. J. Allen.

Competitors must not send actual models. The best thing is to send a photograph, but if this is not possible a clear drawing will do.

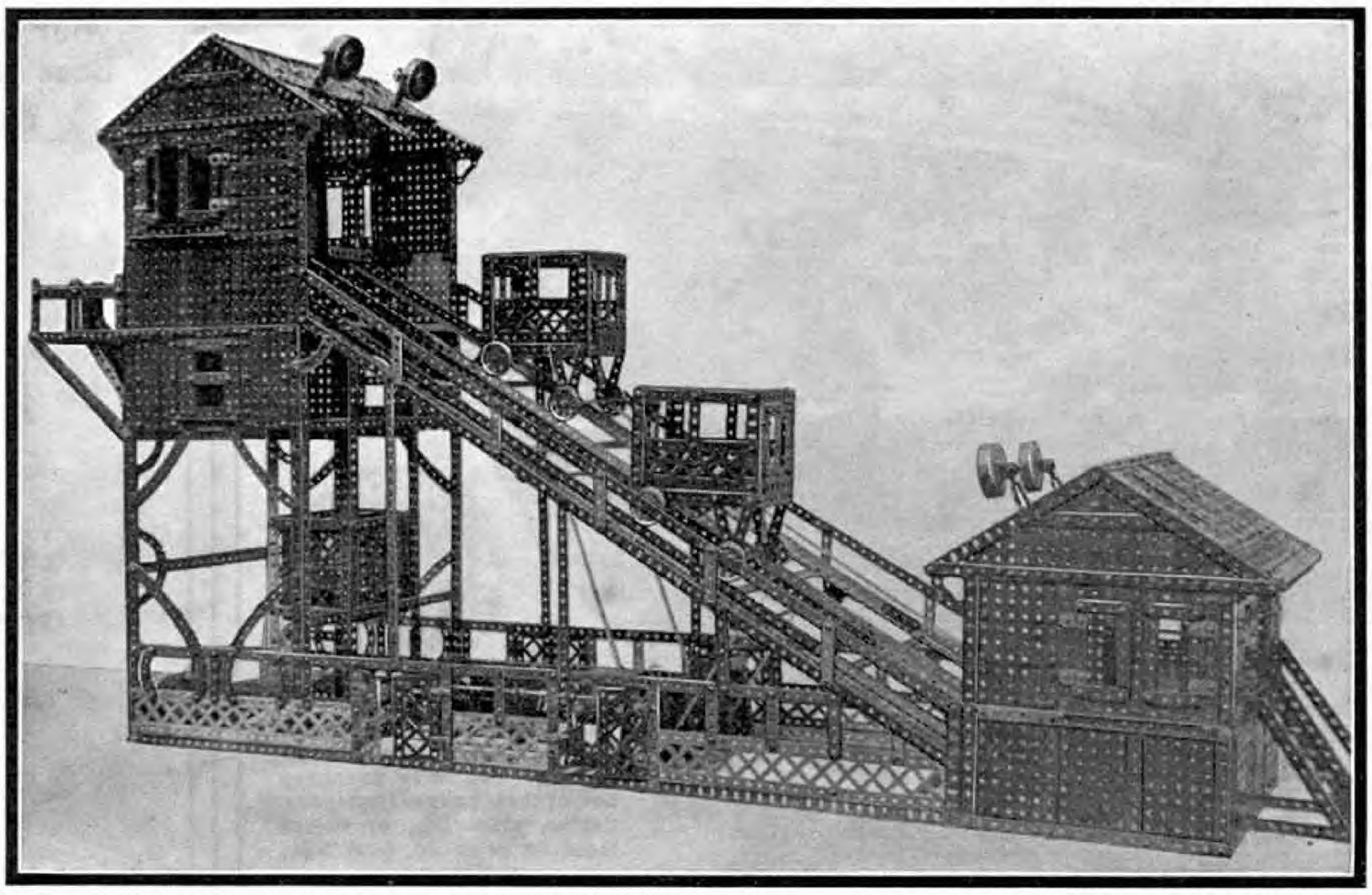
Photographs or drawings must bear the competitor's age, name and address, and should be enclosed in an envelope addressed "Wagon Tippler" Model-building Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool 13.

Photographs or drawings of unsuccessful entries will be returned to competitors provided that a stamped addressed envelope of the necessary size is enclosed with the entry. Photographs or drawings of prize-winning models, however, become the property of Meccano Ltd., and are not returnable to the competitor.

The closing dates are as follows. Section A, 31st May, 1933; Section B, 31st July, 1933.

Competitors should take special care in the preparation of their photographs or drawings, for a good clear photograph or a neat drawing goes a long way towards gaining the favour of the competition judges. A competitor who scribbles a rough sketch on the back of a greasy sugar bag cannot expect his entry to receive much consideration, yet several competitors in recent contests have submitted entries of this sort. One boy sent a miniature drawing sketched on the margin of a daily newspaper! It was impossible to pay any serious attention to it, of course, and it was promptly placed in the waste paper basket.

It should be noted that prize-winning models can only be illustrated in the "*M.M.*" provided that good black and white photographs are sent. Sepia-toned prints are unsuitable for reproduction.



A fine model of an electrically operated mountain railway, which won a prize in the "Winter" Model-building Contest for G. S. King, London, S.W.17.

"Small Outfits" Competition

In this Competition prizes are offered for the best models built from the parts contained in any size Outfit up to and including a No. 2. Competitors are allowed to build any kind of model they like, but models that incorporate parts that are not contained in a No. 2 Outfit will not be eligible. The prizes will be awarded for the models that show the best uses for the parts incorporated, no matter how small and simple the model itself may be. Therefore, the owner of a No. OO Outfit will have just as good a chance of winning a prize as the owner of a No. 2 Outfit.

Models must be original; that is, they must not be copied from any of the models shown in the Meccano Instruction Manuals or other publications. The best subjects for models in a Contest of this kind are those that do not contain complicated mechanisms, and competitors will be well advised to select something simple, so that they can reproduce it as realistically as possible with the limited parts allowed.

Entries will be divided into two Sections—Section A, for competitors under 16 living in the British Isles; and Section B, for competitors under 16 living Overseas. Prizes will be awarded for the best models submitted in each Section as follows. First, cheque for £2-2s. Second, Meccano or Hornby goods value £1-1s. Third, Meccano goods value 10/6. Five prizes of goods value 5/–. Five prizes of "*Famous Trains*" by C. J. Allen.

Actual models must not be sent. A clear photograph or a good drawing is all that is necessary. The competitor's age, name and address must be written clearly on the back of the entry, and if it is considered advisable, a short description of the model may also be submitted. Competitors must also send a list of the parts used in building their models.

Envelopes containing entries should be addressed "Small Outfits" Model-building Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool 13.

Entries for Section A must be posted so as to reach this Office before 31st May, 1933. The closing date for Section B is 31st July, 1933.

Competitors who decide to send drawings are advised to make their sketches on a sheet of paper not larger than this page. Many competitors are in the habit of submitting very big drawings occupying rolls of paper a yard or more in length, which are very difficult to accommodate in our files, as well as being inconvenient for the competition judges to handle.

We are constantly receiving requests from model-builders for competition entry forms, and we are taking this opportunity of stating that entry forms are not required for this contest, or for any of the monthly competitions announced in the Magazine.

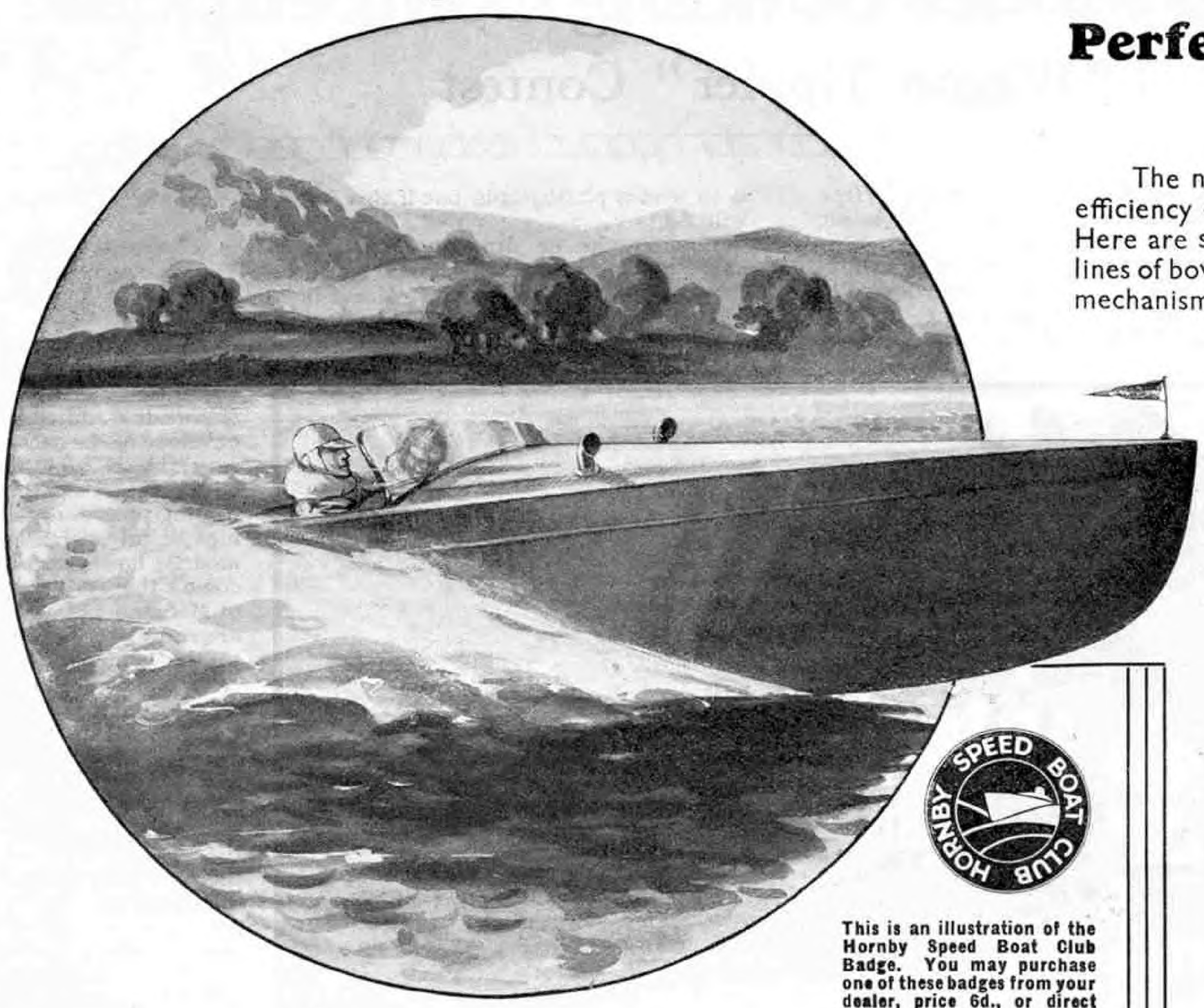
Boys! Get a Hornby

Perfect Design—Except
Unsink

The new 1933 Hornby Speed Boats are supren
efficiency of their performance are the talk of thou
Here are some of the special features of these wor
lines of bow giving great speed ; exceptional length
mechanism by which the boats are propelled ; specia
a special patent water resisting enam

There are five splendid model
your dealer to show them to you,
Boat leaflet in colours.

Get a Hornby Speed Boat to-day, an



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Hornby Speed Boats are the Leaders!

Nothing like the new 1933 Hornby Speed Boats has been known before in model speed boat construction. They are superb ! Each model follows closely the design and general characteristics of the world's famous speed boats. All possible skill and ingenuity has been employed in the manufacture of these new speed boats.



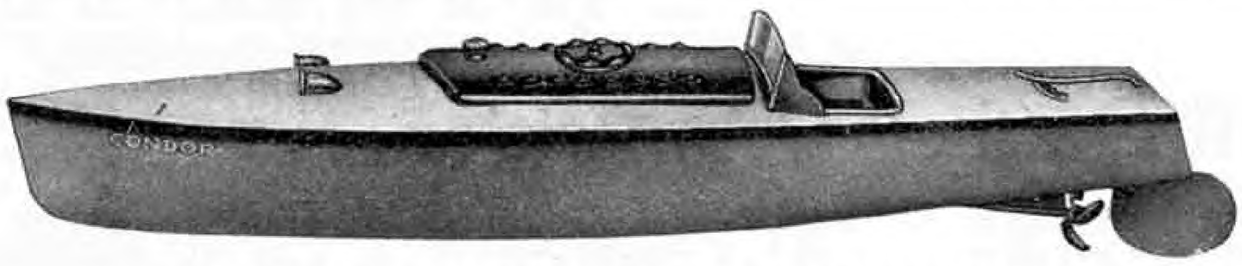
HORNBY SPEED BOAT No. 1.

Hornby Speed Boat No. 1 is a very
length and 2⅜ in. in beam. It will travel ov
in three different colour combinations—Re
Orange and Green.



HORNBY SPEED BOAT No. 2

The exceptionally fine performance of
it one of the most popular of the Hornby
on one winding. Finished in three diffe
Cream, Blue and White, and Yellow and V
Beam, 3 in.



HORNBY SPEED BOAT No. 3. PRICE 12/6

Hornby Speed Boat No. 3 has already established itself as a great favourite. It will travel over 500 feet on one winding. Available with three different names and in three different colour combinations, as follows :—**"Condor"** (Red and Cream), **"Gannet"** (Blue and White), **"Curlew"** (Green and Ivory). Dimensions : Length, 16½ in. Beam, 3½ in.



HORNBY LIMOUSINE BOAT No. 4.

This realistic Hornby Limousine Speed
It will travel over 500 feet on one windin
combinations—Red and Cream, Blue and
Dimensions : Length, 16½ in. Beam, 3

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supreme ! The beauty of their appearance and the of thousands of speed boat enthusiasts everywhere. se wonderful boats—streamlined hull and fine entry ength of run, due to the general excellence of the special design of propeller ; attractively finished with enamel in a range of choice colour combinations.

dels in the series ranging from 5/– upwards. Ask . o send to us for a copy of the Hornby Speed

day, and be first to smash records on your local pond !



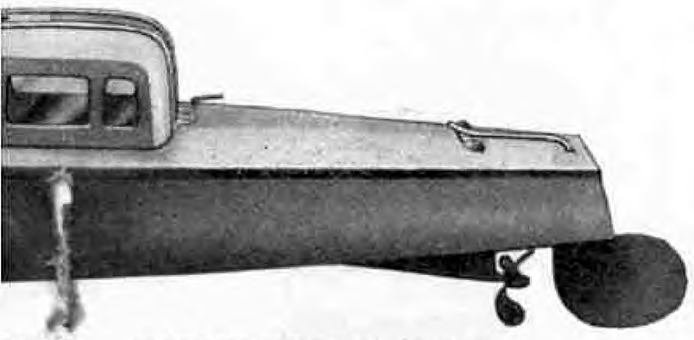
. 1. "MARTIN." PRICE 5/–

a very efficient model, measuring 8½ in. in avel over 160 feet on one winding. Finished ons—Red and Yellow, Blue and White, and



No. 2. "SWIFT." PRICE 7/6

nce of Hornby Speed Boat No. 2 makes lornby models. It will travel over 300 feet e different colour combinations—Red and and White. Dimensions : Length, 12½ in.



No. 4. "VENTURE." PRICE 15/6

Speed Boat No. 4 is a magnificent model. winding. Finished in three different colour e and White, and Jade Green and Ivory. m, 3½ in.

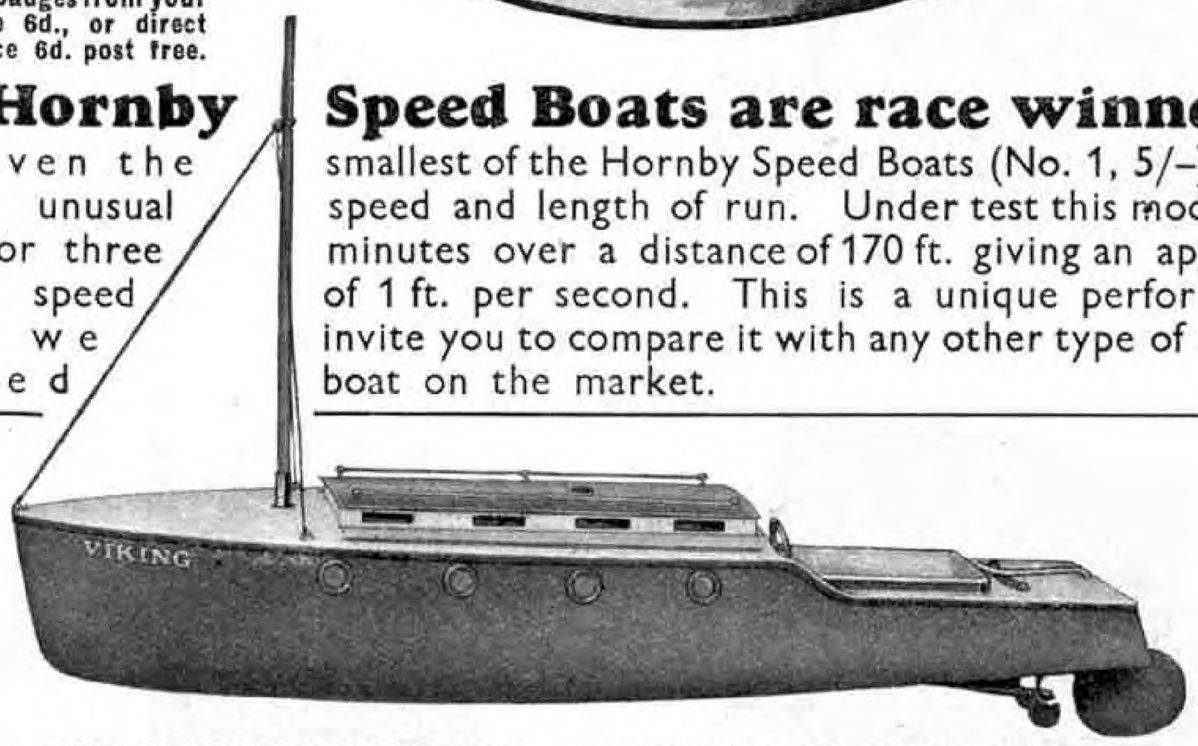


SPEED BOAT CLUB HORNBY

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Hornby Speed Boats are race winners!

Even the smallest of the Hornby Speed Boats (No. 1, 5/–) has a most unusual speed and length of run. Under test this model has run for three minutes over a distance of 170 ft. giving an approximate speed of 1 ft. per second. This is a unique performance and we invite you to compare it with any other type of model speed boat on the market.



HORNBY CABIN CRUISER No. 5. "VIKING." PRICE 16/6

The perfect design and handsome appearance of Hornby Cabin Cruiser Speed Boat No. 5 makes it a model of outstanding merit. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions : Length, 16½ in. Beam, 3½ in.

— BINNS ROAD — LIVERPOOL 13

PEED BOATS

MECCANO



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Builds 343 Models



MECCANO OUTFIT No. 1
Builds 573 Models



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Builds 753 Models

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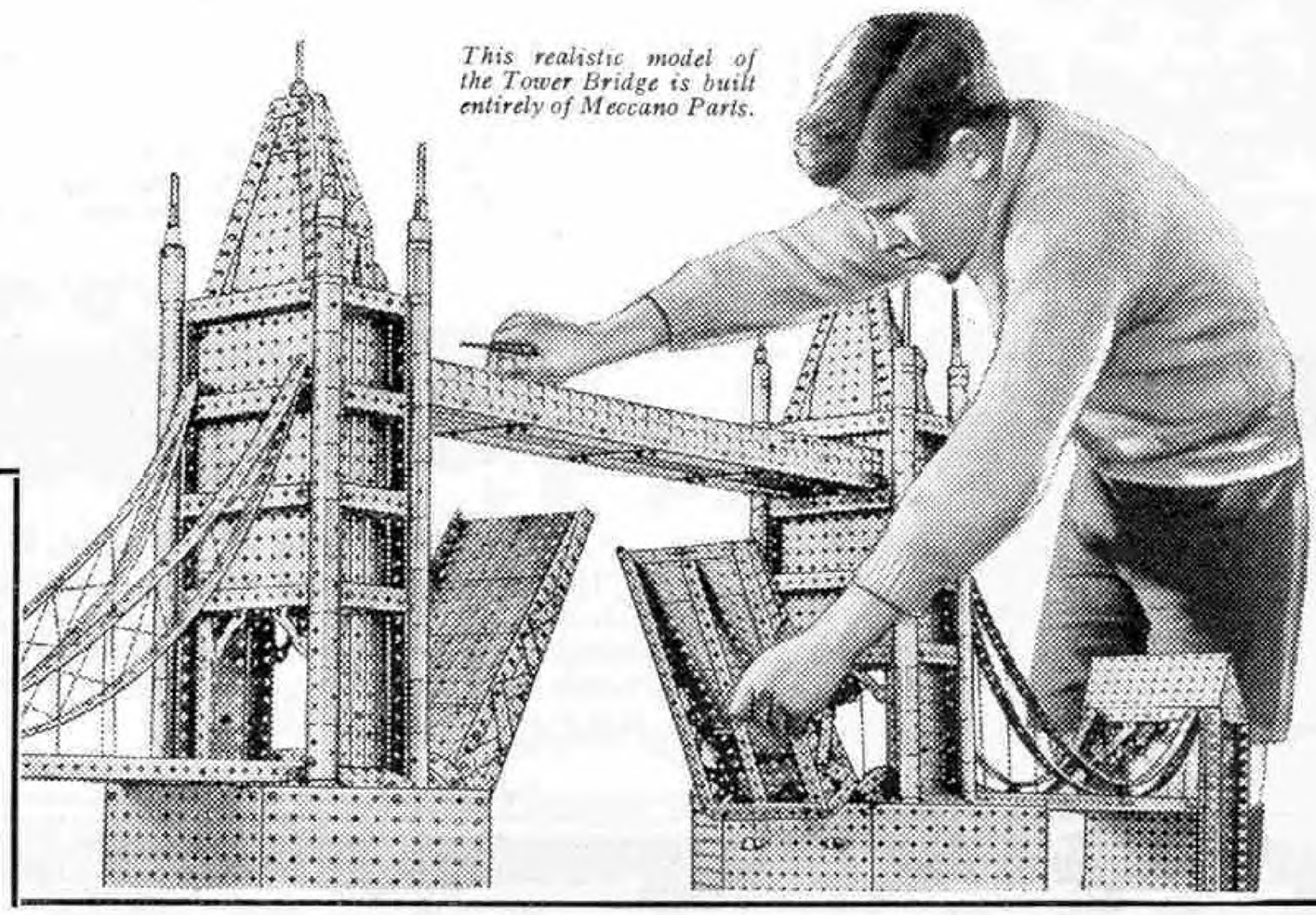
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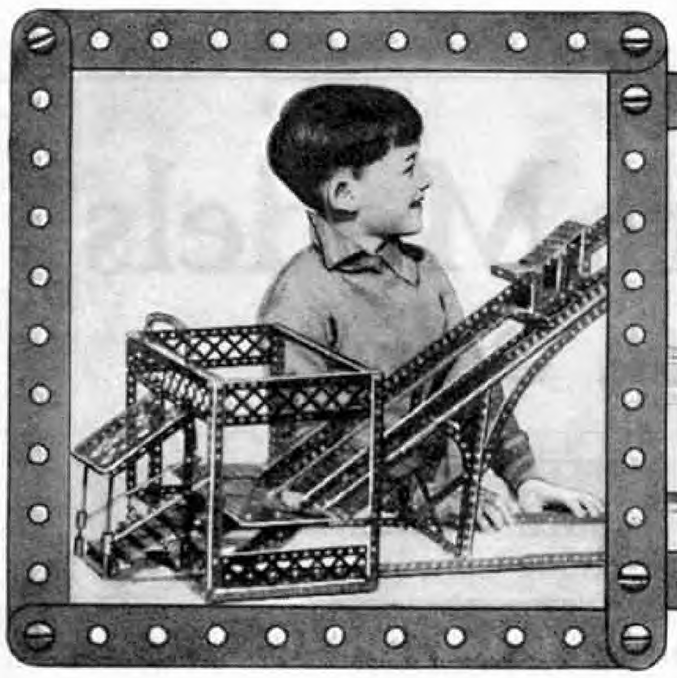
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Outfit	Builds	Price	Outfit	Builds	Price
No. X1	70 models	**1/3**	No. 3	687 models	**27/6**
No. X2	96 „	**2/-**	No. 4	753 „	**52/6**
No. OOO... ...	162 „	**2/6**	No. 5 (Carton) ...	798 „	**70/-**
No. OO	189 „	**3/6**	No. 5 (Cabinet) ...	798 „	**100/-**
No. O	343 „	**5/-**	No. 6 (Carton) ...	844 „	**125/-**
No. 1	573 „	**10/-**	No. 6 (Cabinet) ...	844 „	**155/-**
No. 2	629 „	**16/-**	No. 7 (Cabinet) ...	889 „	**415/-**

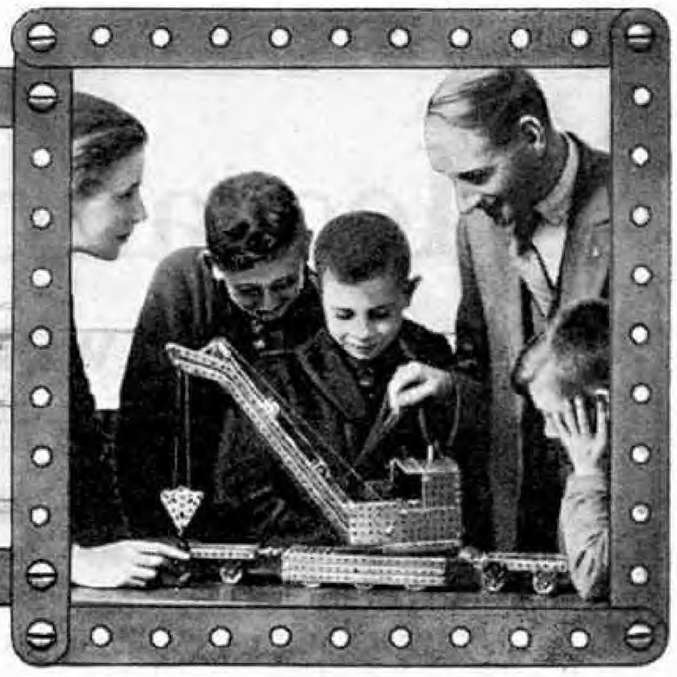


This realistic model of the Tower Bridge is built entirely of Meccano Parts.

MECCANO LTD. (Dept. 70), Binns Road, Liverpool 13



WITH THE MODELBUILDERS



INTERNAL EXPANDING BRAKE

The construction of an efficient brake forms an interesting subject for the model-builder, and many ingenious designs for different types have been produced. One of the most powerful braking devices is the external-contracting type, in which two hinged concave shoes are brought into contact with the outside surface of a drum attached to the revolving shaft. This type can be reproduced quite easily in Meccano, and examples will be found in the Standard Mechanisms Manual.

In actual engineering, the drawback to the external-contracting type of brake is the difficulty of providing adequate ventilation for the braking surfaces, so that the heat caused by friction may be dissipated. This drawback does not, of course, apply in the case of a Meccano model, as the friction and torsional stresses are not great; but in many cases the external contracting brake cannot be used in Meccano models owing to its relatively large size. For this reason the compact internal-expanding type is made use of in many Meccano models, an outstanding example being the Meccano Motor Chassis (Super Model No. 1).

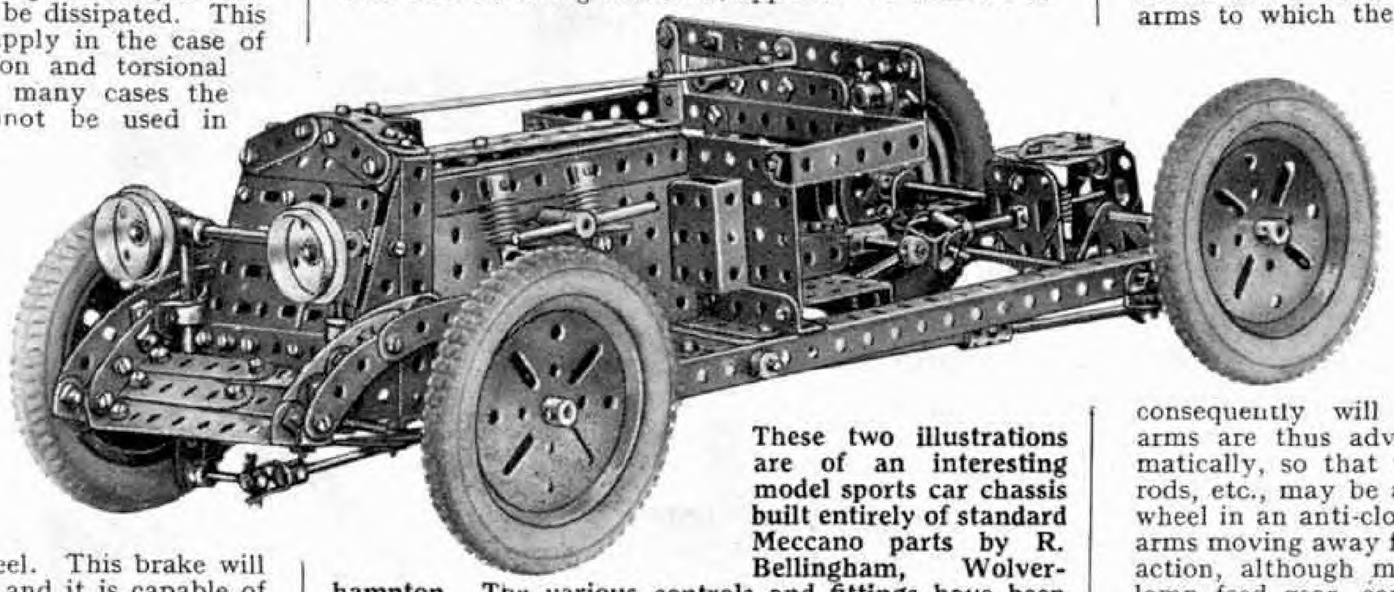
Brakes of the internal-expanding type are fitted to the rear wheels of the Chassis, and in each case the mechanism consists of Collars mounted on arms that are forced against a brake drum consisting of a Wheel Flange secured to the inside face of each rear road wheel. This brake will be found to function quite well, and it is capable of holding the Chassis at rest even when loaded on an incline.

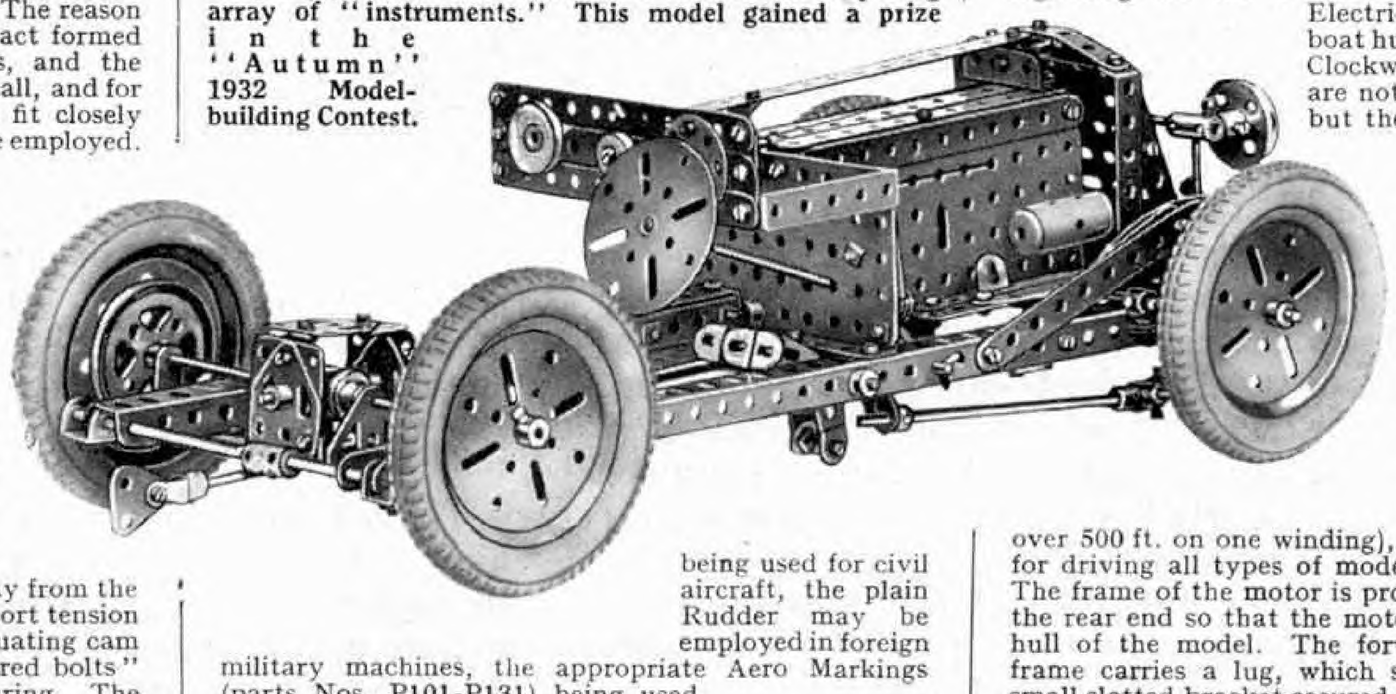
If an internal-expanding brake is required for the hoist shaft of a model crane or other machine where considerable weights have to be dealt with, the brake just mentioned will not be altogether satisfactory, as it will tend to slip under a heavy load. The reason for this is that the area of fractional contact formed between the Collars that serve as shoes, and the internal surface of the Wheel Flange, is small, and for more efficient operation brake shoes that fit closely to the concave surface of the drum should be employed. The area of contact can also be increased by using a deeper brake drum.

A brake of the internal-expanding type that incorporates these features may be built up in the following manner. A Boiler End is used for the brake drum, and the shoes, which are of the semi-circular "Bendix" type, are hinged together at one end, while the free ends are controlled by a Cam mounted between them. Each brake shoe consists of a 2½" Double Angle Strip. The Angle Strips are pivoted together at one end by means of two Double Brackets, and the lug at the other end of each Strip is bent down so as to provide a surface against which the actuating cam can operate. The brake shoes are held away from the surface of the brake drum by means of a short tension spring formed from Spring Cord. The actuating cam itself is a Collar fitted with two "shouldered bolts" removed from the spider of a Swivel Bearing. The Collar is locked on a Pivot Bolt coupled to the brake lever through suitable links, so that on actuating the brake lever the Collar fitted with Bolts is rotated, the Bolts thereby pressing the shoes against the surface of the brake drum. This brake will be found to provide a very powerful action. Its braking effect can be increased further by attaching strips of No. O gauge sand-paper to the portions of the shoes that make contact with the drum. The sand-paper may be secured in place by means of shellac varnish.

A NEW RUDDER FOR CIVIL AIRCRAFT

Meccano Aeroplane engineers will know that British aircraft are divided into two distinct categories, civil machines and aircraft for military purposes. British military machines are distinguished by having red, white and blue ring marks on main planes and fuselage, and red, white and blue panels are painted on the rudder section of the machine. The Meccano No. 1 and No. 2 Aero Outfits contain suitable identification discs for marking the planes and fuselages of the models, while the Rudder (No. P32) supplied with the outfits is painted in red, white and blue panels as in actual practice. Civil aircraft do not carry the red, white and blue markings mentioned above, but instead have registration letters painted in black. The inclusion of correct registration lettering for the various types of commercial and privately-owned craft that can be built with the Outfits would of course be impracticable, but an improved effect can be obtained by omitting the military marks from the planes and fuselage, and by using the new civil type Rudder. This Rudder (Aero part No. P64) is identical in shape and size with the original Rudder (Military) No. P32, but is finished in plain aluminium enamel, the red, white and blue colouring not being applied. In addition to being used for civil aircraft, the plain Rudder may be employed in foreign military machines, the appropriate Aero Markings (parts Nos. P101-P131) being used.





These two illustrations are of an interesting model sports car chassis built entirely of standard Meccano parts by R. Bellingham, Wolverhampton. The various controls and fittings have been cleverly reproduced, the sloping radiator and "apron" being well designed, while the mounting of the headlights (Meccano 1½" Flanged Wheels) should also be noted. The engine unit is provided with dual carburetters (Meccano Worms), and an intake manifold built from Rods and Couplings, while the dash-board carries an imposing array of "instruments." This model gained a prize in the "Autumn" 1932 Model-building Contest.

NOVEL WORM GEAR ACTIONS

The standard Worm Gear mechanism making use of a Meccano Worm and a 57-teeth Gear Wheel will be familiar to most Meccano engineers, as the Gear is used in many types of models requiring a large reduction in a small space, a ratio of 57 : 1 being actually obtained. The Meccano Worm may be used also to produce several novel mechanical movements, apart from the standard worm reduction drive. It can be employed, for instance, for converting a sliding or reciprocating action into alternating rotary motion. The Worm is mounted on a Rod that is free to slide backward and forward in its bearings, and a Gear Wheel is mounted on a second axle so that its teeth mesh with the threads of the Worm. The Axle carrying the Worm may be reciprocated either by a Crank, or by means of two Solenoids that are excited alternately and thus pull the Rod from side to side. As the Worm passes backward and forward its threads draw the teeth of the Gear Wheel round, and thus a partial rotary action is given to the Wheel.

Another interesting worm gear action making use of a Worm and two 57-teeth Gears may be used to produce the "scissors" action that is used in arc lamps and other mechanisms where two arms have to be brought together or moved apart simultaneously. The Worm is secured on a Rod mounted in suitable bearings, and a Hand Wheel is fitted to one end of this Rod for control purposes. A 57-teeth Gear is mounted above and below the Worm so that the teeth of both Wheels are in engagement with the threads of the Worm. Meccano Strips bolted to the faces of the 57-teeth Gear Wheels form arms to which the carbon electrodes, etc., may be secured.

When the Hand Wheel is operated so that the Worm shaft rotates in a clockwise direction, the upper 57-teeth Gear Wheel is driven round anti-clockwise, and the Strip secured to it is consequently lowered. At the same time the rotation of the Worm causes the lower 57-teeth Gear to be driven round in a clockwise direction, and the arm attached to this Wheel consequently will be moved upward. The two arms are thus advanced towards each other automatically, so that the distance between the carbon rods, etc., may be adjusted; rotation of the control wheel in an anti-clockwise manner will result in both arms moving away from each other. This "scissors" action, although mentioned in connection with arc lamp feed gear, can also be applied in many other types of machines, and model-builders are sure to be able to find uses for the idea.

MARINE POWER UNIT

Constructors have written to us from time to time regarding the use of the Meccano Clockwork and Electric Motors in model power boat hulls. The larger Meccano Clockwork and Electric Motors are not suitable for boat work, but the Meccano E1 Motor (6-volt) forms a compact driving unit that may be used in a model motor boat.

For those boys who wish to use a Clockwork Power Unit in their boats, we are now supplying the spring motor of the Hornby No. 3 Speed Boat as a separate unit. This Motor is very powerful (it drives the Hornby Speed Boat over 500 ft. on one winding), and it will be found ideal for driving all types of model boats up to 24" long. The frame of the motor is provided with two holes at the rear end so that the motor may be bolted to the hull of the model. The forward end of the motor frame carries a lug, which should be inserted in a small slotted bracket secured to the hull of the vessel. The Meccano Boat Motor naturally works best with a propeller that is designed specially for it, and a special three-blade propeller complete with shaft can be supplied.

NEW ENGINE CASTING. We were interested in your idea that a metal casting should be added to the Aero Constructor parts to represent the "in line" type of air-cooled engine used in light aeroplanes. This idea has possibilities, but considerable difficulty would be experienced in fitting such a casting in place on the front of the fuselage of an existing Constructor Aeroplane. If extensive modifications were made to the fuselage sections it might be possible to fit the unit in position, but the engine casting would not represent the latest aeroplane practice, as the "in line" engines fitted to modern machines are generally almost totally enclosed in the fuselage. *(Reply to T. S. Silverman, Birmingham.)*

Meccano Power Driven Models

Clockwork Motors Applied to Small Outfits

THE greatest thrill of all in Meccano model-building is to set the finished models working just like the actual machines they represent. The fascination of the hobby is increased enormously if a power unit is applied to a working model, as by a touch of a lever it can be started, stopped, or even reversed. Three distinct sources of power are available in the Meccano system, namely, Clockwork Motors, Electric Motors and the Steam Engine. Each type has its own advantages and limitations, and its applications depend to a large extent on the type of model to which the power is to be applied.

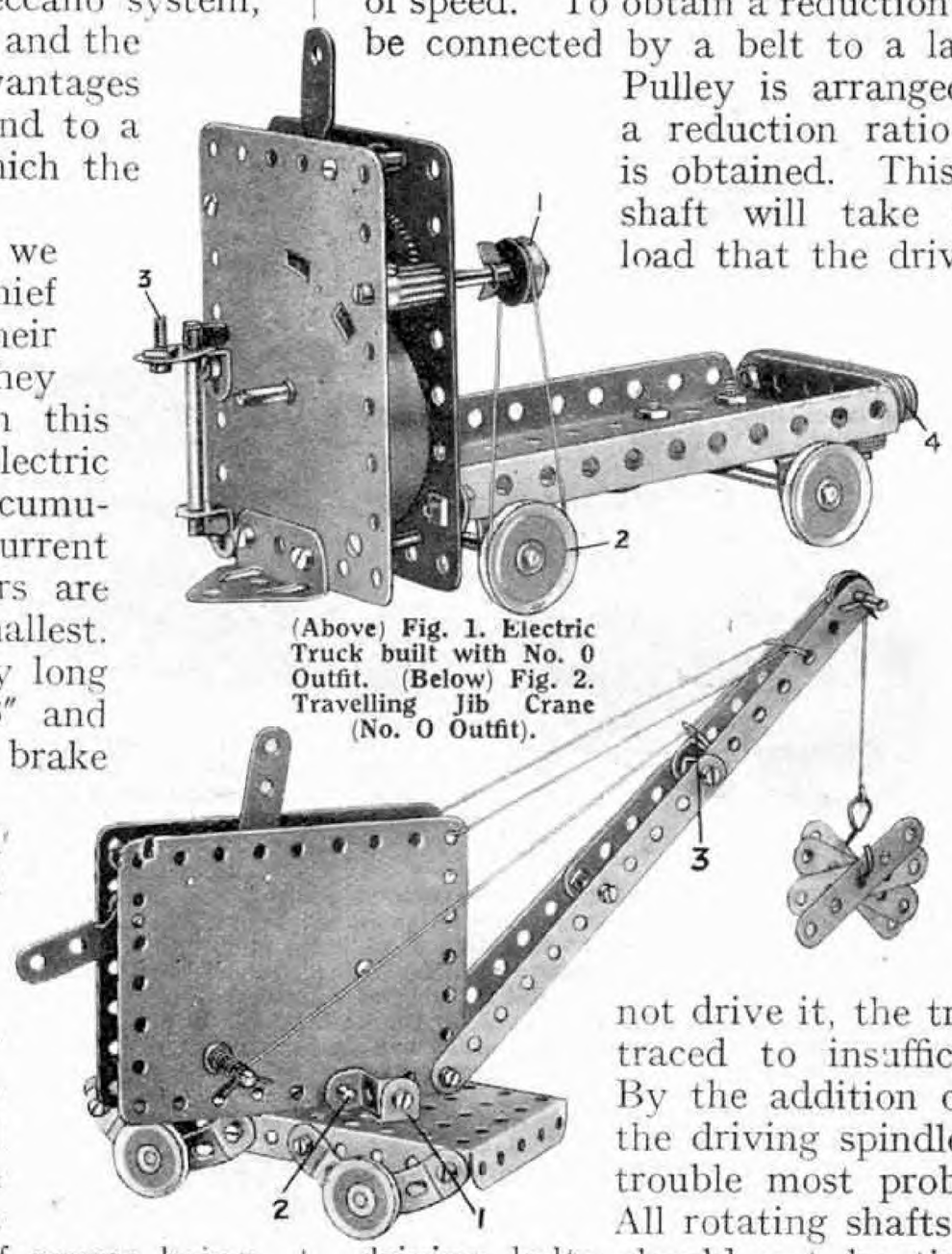
It is with the Clockwork Motors that we propose to deal in this article. Their chief advantages over the other power units are their extreme simplicity and ease of operation. They are entirely self-contained units, and in this respect have an advantage over the Electric Motors, which must be connected up to an accumulator or transformer for the electric current supply. Three sizes of Clockwork Motors are available, the No. 1 Motor being the smallest. This is a powerful unit with a remarkably long run. It has side plates measuring 4″×3″ and spaced apart ¾″, and is provided with a brake lever. The Motor is non-reversing.

The No. 1A Motor has a more powerful drive, but not such a long run, and is fitted with a reversing movement. The side plates measure 4½″×3½″ and are spaced ¾″ apart. A power unit of similar dimensions, but with the plates spaced ⅞″ apart, is the No. 2 Motor, which has a very long run and is easily the most powerful of the three. These motors are to a large extent interchangeable, and in most cases any type can be used, the No. 1 Motor of course being unsuitable where a reverse drive is required.

In each case the driving shaft supplied is 1½″ in length, and is detachable so that a longer or shorter Rod can be substituted if necessary. In order to do this the Set Screw in the Pinion on the Rod is slackened off, thus enabling the Rod to be slid out of place. A Rod of suitable length can then be inserted and the Set Screw again tightened up.

When a Motor is to be incorporated in a small model, it should be made to represent some part of the actual structure if the maximum degree of realism is to be achieved. The models illustrated in this article show how the Motors can be made to add to the attractiveness of the models, as well as to increase their interest and efficiency. It will be seen from these examples that much better results are obtained when the Motor actually forms a part of the model than would be the case if it were added as an afterthought solely for driving purposes. Fig. 5 shows a model that can be used with or without the Motor with scarcely any alteration in general design.

In building the Motors into models it is important to consider what type of work is to be carried out. If only a light drive is required the model may be driven direct from the motor driving spindle, or through a belt and Pulleys providing a 1 : 1 ratio. This is obtained by using two Pulleys of the same size. When a more powerful drive is necessary, reduction gearing must be employed, but the increase in driving force is obtained at the sacrifice of speed. To obtain a reduction gear a small Pulley must be connected by a belt to a larger one. Thus if a 1″ Pulley is arranged to drive a 3″ Pulley, a reduction ratio of approximately 3 : 1 is obtained. This means that the driven shaft will take about three times the load that the driving shaft would handle, but it rotates at only one-third of the speed. To increase the reduction ratio, a further 1″ Pulley is placed on the shaft of the 3″ Wheel and made to drive a second 3″ Pulley. This will give a total reduction gear of 9 : 1.



(Above) Fig. 1. Electric Truck built with No. 0 Outfit. (Below) Fig. 2. Travelling Jib Crane (No. 0 Outfit).

All the models illustrated in this article give satisfactory results if constructed as shown, but if the reader finds that on designing a new model the Motor will not drive it, the trouble very likely can be traced to insufficient reduction gearing. By the addition of a 3 : 1 stage between the driving spindle and the road axle the trouble most probably will be overcome. All rotating shafts should be free, and the driving belts should not be tight. Rubber bands are more satisfactory than cord in most cases where only a light drive is required. The belt should always be fed on to a Pulley in a direct line with the groove, but the angle at which it leaves the Pulley is not so important.

Electric Delivery Truck

The Flanged Plate forming the body of the truck is fixed to the Clockwork Motor, at one side by a Bolt passed through the Plate and Motor side plate, and at the other side by means of an Angle Bracket. Two 2½″×½″ Double Angle Strips are attached to the underside of the Plate, and carry 3½″ Axle Rods on the ends of which are 1″ Pulleys.

The back of the model is weighted by means of nine 2½″ Strips 4 and four 2½″ Curved Strips to balance the weight of the Motor. The driver's platform consists of a Trunnion, and a dummy control handle is represented by a ⅜″ Bolt 3, fixed to a Flat Bracket carried on a 2″ Rod.

The driving shaft of the Motor should be removed and a 2″ Axle Rod inserted in its place. A ½″ Loose Pulley 1 is clamped between two Spring Clips on this Rod, and drives the front pair of road wheels 2 through a rubber band.

Parts required: 9 of No. 5; 1 of No. 10; 3 of No. 12; 2 of No. 16; 2 of No. 17; 4 of No. 22; 1 of No. 23; 4 of No. 35; 11 of No. 37; 5 of No. 37a; 2 of No. 48a; 1 of No. 52; 4 of No. 90a; 5 of No. 111c; 1 of No. 126; 1 Rubber Band; 1 No. 1 Clockwork Motor.

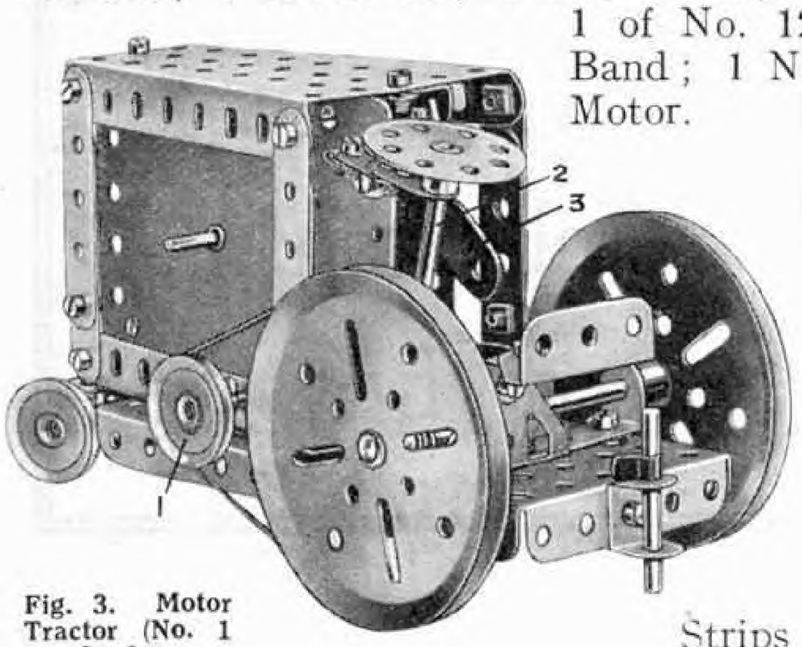
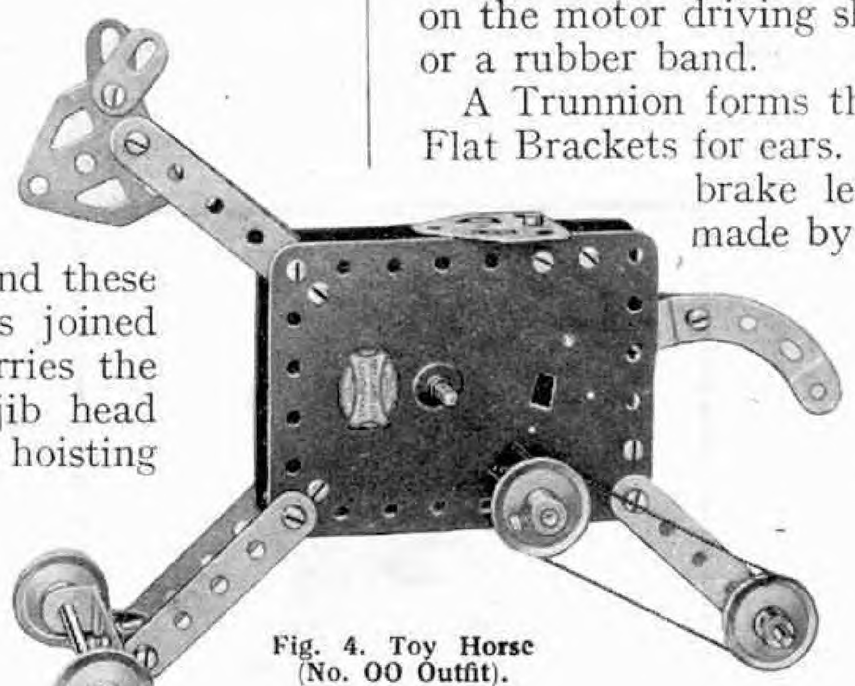


Fig. 3. Motor Tractor (No. 1 Outfit).

Travelling and Swivelling Crane

The base truck is made of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, with $2\frac{1}{2}''$ Curved Strips bolted to the sides to form bearings for $3\frac{1}{2}''$ Axle Rods carrying the travelling wheels. A $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 1 is pivoted to the plate by a Bolt passed through its centre hole and through the plate, and carrying at its lower extremity lock-nuts. At each end of the Double Angle Strip is a $\frac{1}{2}''$ Reversed Angle Bracket, and a $1\frac{1}{2}''$ Rod 2, passed through these, anchors the No. 2 Clockwork Motor. The Brackets are spaced from the Motor by Spring Clips on the Rod. At the front of the Motor a pair of $5\frac{1}{2}''$ Strips are bolted, and these are extended by further similar Strips joined together by a Double Bracket that carries the Flat Bracket 3. A $1\frac{1}{2}''$ Rod at the jib head carries a $\frac{1}{2}''$ Pulley Wheel over which the hoisting cord passes.

A 2″ Axle Rod is inserted in place of the motor driving spindle, and the hoisting cord is fixed to it by a Spring Clip. The cord passes through the Flat Bracket 3 before going over the $\frac{1}{2}''$ Pulley Wheel.


Fig. 4. Toy Horse (No. OO Outfit).

Parts required:—4 of No. 2; 4 of No. 5; 1 of No. 10; 1 of No. 11; 2 of No. 16; 2 of No. 17; 4 of No. 22; 1 of No. 23; 5 of No. 35; 1 of No. 40; 16 of No. 37; 3 of No. 37a; 1 of No. 48a; 1 of No. 52; 1 of No. 57; 4 of No. 90a; 2 of No. 111c; 2 of No. 125; 1 No. 2 Clockwork Motor.

Clockwork Driven Motor Tractor

The first stage in building this model is to bolt a Sector Plate to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The Clockwork Motor is bolted down by means of Angle Brackets, further Angle Brackets being used to secure a Sector Plate to the top of the Motor. The two Sector Plates are connected together by means of $2\frac{1}{2}''$ Strips extended by similar Strips. A Flat Trunnion is bolted beneath the lower Plate and a $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is pivoted to this. A 2″ Rod passed through the Double Angle Strip is fitted with the front wheels. Steering is effected by a length of Cord wound once round a 1″ Pulley on the lower end of the steering column 2. This consists of a $3\frac{1}{2}''$ Axle Rod journalled in the Flanged Plate, and in a Flat Bracket secured by a further Flat Bracket and Angle Bracket to the Motor.

The rear axle is carried in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted to the Plate. A Trunnion secured under the Double Angle Strip has a second Trunnion fixed to it by an Angle Bracket to form the seat. A Washer is placed under the Double Angle Strip at the other end to allow for the thickness of the Trunnion.

A 2″ Rod is substituted for the driving shaft of the Motor, and passes through one of the flanges of the lower Sector Plate. It carries the Pulley 1 that drives the rear wheel by means of a rubber band. The Motor is controlled by the brake lever 3.

Parts required:—8 of No. 5; 2 of No. 10; 1 of No. 11; 6 of No. 12; 2 of No. 16; 2 of No. 17; 2 of No. 19b; 4 of No. 22; 1 of No. 24; 1 of No. 35; 33 of No. 37; 1 of No. 37a; 5 of No. 38; 1 of No. 48; 1 of No. 48a; 1 of No. 52; 2 of No. 54; 2 of No. 126; 2 of No. 126a; 1 Rubber Band; 1 No. 1 Clockwork Motor.

Toy Horse on Wheels

The No. 1 Clockwork Motor is made to form the body of the horse, and to this the legs and neck are bolted. These are represented by $2\frac{1}{2}''$ Strips, and the front legs are connected by Angle Brackets that carry a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, through which passes the $3\frac{1}{2}''$ Rod fitted with a 1″ Pulley at each end.

The rear wheel is carried on a 2″ Axle Rod passed through the $2\frac{1}{2}''$ Strips, and fitted with a Spring Clip to retain it in position. The Pulley is driven from a similar Pulley on the motor driving shaft by means of a length of Cord or a rubber band.

A Trunnion forms the head and is provided with two Flat Brackets for ears. A $2\frac{1}{2}''$ Curved Strip bolted to the brake lever forms the tail. A saddle is made by fixing a Flat Trunnion to the top of the Motor by an Angle Bracket.

Parts required:—6 of No. 5; 2 of No. 10; 3 of No. 12; 1 of No. 16; 1 of No. 17; 4 of No. 22; 2 of No. 35; 14 of No. 37; 1 of No. 40; 1 of No. 48a; 1 of No. 90a; 2 of No. 126a; 1 No. 1 Clockwork Motor.

Electric Tram Car

The Motor is secured to the base plate by Angle Brackets 2, and when tightening up the fixing bolts care should be taken to make sure that the holes in the Motor side plates are in a direct line with those in the Flanged Plate. To do this the $3\frac{1}{2}''$ Axle Rods should be inserted, and when the Motor is correctly placed they should rotate freely. The Rod 1 replaces the $1\frac{1}{2}''$ Rod supplied with the Motor.

A Crank Handle represents the overhead trolley and is fixed to an Angle Bracket by two Spring Clips. A Third Clip on the end of the trolley holds the cord led down to the back of the tram.

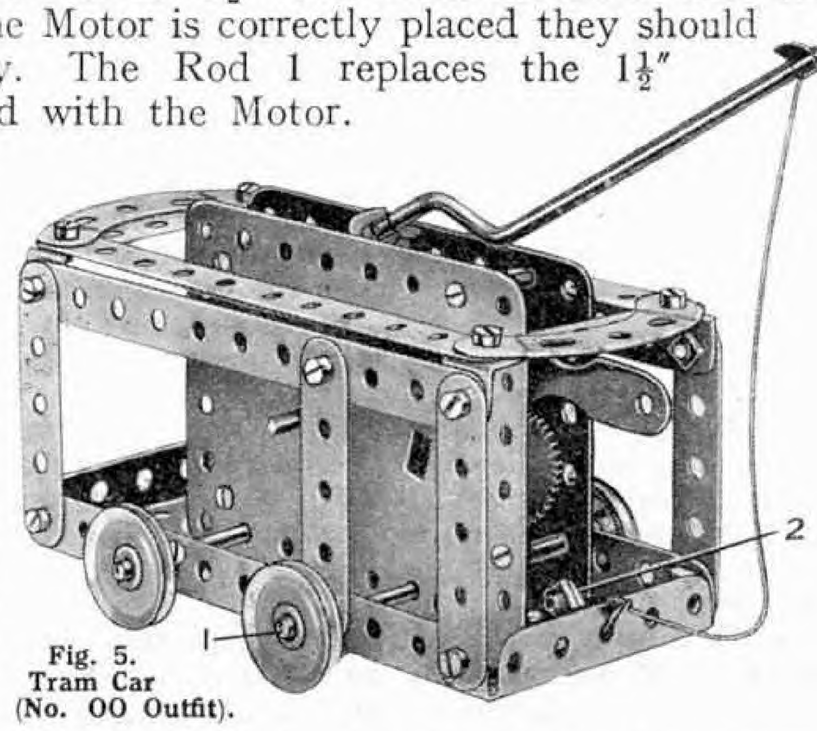


Fig. 5. Tram Car (No. OO Outfit).

Parts required:—4 of No. 2; 6 of No. 5; 3 of No. 12; 2 of No. 16; 1 of No. 19s; 4 of No. 22; 3 of No. 35; 16 of No. 37; 4 of No. 37a; 1 of No. 40; 2 of No. 48a; 1 of No. 52; 2 of No. 90a; 3 of No. 111c; 1 No. 1 Clockwork Motor.

The Meccano Guild



A Great Fellowship of Boys

More Enjoyable Programmes

The beginning of April is an excellent time for a review of the recent progress of Meccano clubs, for it marks a turning point in the course of club life. I have no hesitation in saying that the winter sessions of 1932-33 have been the most successful since the formation of the Guild. In all quarters I have noted signs of increasing keenness and have been particularly impressed by the evidence, contained in reports and letters, of the care and forethought devoted by Leaders and other officials to the preparation of club programmes. The results have been seen in the enjoyment that members have derived from the varied and attractive fare provided for them.

With the approach of the outdoor season the thoughts of members naturally turn to summer games and recreations. It is no longer necessary to urge Leaders to work out schemes for keeping their members in touch with each other during the summer months, however, for to-day practically every Meccano club arranges a suitable programme for this purpose. The general outlines of such a programme are well known. Cricket, rambles and picnics, cycling runs and visits to places of special interest to Meccano enthusiasts give splendid opportunities for open air recreation, and members almost automatically find their way to the club room when the weather is unfavourable for the usual outdoor activities.

Making the Best of Visits

I have often wondered why greater use is not made of club magazines in keeping members in touch with each other during the summer. Most productions of this kind appear regularly throughout the year. In certain instances publication ceases for a time, however, and it is not always easy to pick up the threads again when the indoor season comes round. If special difficulties prevent the appearance of normal issues in summer, a less ambitious production containing news of club activities and attractively-worded announcements of coming events should be circulated. Even in a very small magazine room could be found also for notes on a topic of immediate interest, such as a forthcoming visit to a place of historic importance or to a district rich in animal or bird life. A well-planned preliminary account of this kind will add greatly to the enjoyment of the event itself.

I should like to make one other suggestion in regard to club magazines. It always seems to me that summer is an excellent time for the first appearance of a new journal, for its editor will gain experience that will enable him to produce a magazine of which he may be proud during the following winter sessions. If the first steps are left until September or October, when everybody is busy with the usual preparations for the indoor programme, delays and disappointments are almost inevitable, and a wise editor will take advantage of the comparative quiet of the summer sessions to arrange in advance interesting contributions for winter issues.

Meccano Club Leaders

No. 64. Mr. H. K. Lynas



Mr. H. K. Lynas is the capable and energetic Leader of the Eston Scouts M.C. This club was affiliated in October, 1931, and is remarkable for the variety and originality of its programme. Special interest is taken in Model-Building Contests and in general competitions based on the current issue of the "M.M."

Novel Features in Club Magazines

I am often asked how a club magazine should be produced and what it should contain. Actual production offers little difficulty. In most cases printed magazines are out of the question, but satisfactory reproduction may be obtained by the use of stencils cut on a typewriter. Copies taken from these with the aid of a duplicator have a very neat appearance and may be read with ease. For less ambitious magazines the jellygraph may be employed. The results are not as good as those given by the method already described, but they are satisfactory, and the system has the great merit of being inexpensive. I should be pleased to give more detailed advice on this point to those who are contemplating the issue of a magazine as part of their work.

It is impossible to lay down definite rules in regard to the contents of a club magazine, for the character of these depends on the tastes of members themselves—and also on their capacity for providing the editor with contributions. Apart from items of club news and the general articles of an attractive type that should always be included, special attention should be paid to features of local or topical interest. In this respect *"The Gearbox,"* the official organ of the Plymouth M.C., sets a good example, for every issue contains notes of local railway activities, and a series of articles on *"The Railway History of Cornwall and Devon"* is now being published. A specially interesting feature of recent issues has been *"The Story of the Plymouth Tramways."* This is contributed by an enthusiast who studies Plymouth tramways and omnibuses as thoroughly as railway enthusiasts track down locomotives, and brief notes on tramway developments in the city also illustrate how interest may be aroused in local topics.

* * * * *

Fallowfield Life Boys (Manchester) M.C. have arranged a Handicrafts Exhibition for Saturday, 8th April. It will be held at Cavendish Street Congregational Church Schools, All Saints, Manchester, and proceedings will commence at 6 p.m.

The Second Annual Exhibition of the Streatham Common Branch of the H.R.C. is to be held at 70, Conyers Road, S.W.16, on 28th and 29th April. The Exhibition will be opened at 3 p.m. and a charge of 3d. will be made for admission.

I also wish to remind Harlesden readers of the Exhibition of the Harlesden Wesleyan M.C., to be opened at 2.30 p.m. on 8th April in the Lecture Hall, Tavistock Road. In conjunction with the Wembley M.C. this club has organised a second Exhibition to be held on 29th April, in Tokyngton Church Hall. Proceedings will commence at 2.30 p.m., admission 2d.

Proposed Clubs

ABERGELE—Mr. T. Standring, Kinmel Arms Bungalow, St. George.
EAST BARNET—F. G. Gear, Quetta, 30, Cranbrook Road.
KENTON—J. M. G. Boultbee, 4, Draycott Avenue.



CLUB NOTES



Bury Municipal Secondary School M.C.—Special attention has been given to Wireless Construction, the club's one-valve receiver having been enlarged to a two-valve set. Satisfactory frame aerials have been made from Meccano parts. Model-building meetings are held weekly and an extensive range of ingenious working models is being produced. Club roll: 20. *Secretary:* J. W. Paine, "Bowerham," Halvard Avenue, Bury.

Whitgift School (Croydon) M.C.—Members who are unable to continue owing to pressure of work, but retain their interest in the club, are elected Associate Members, and attend meetings of special interest to them. Model-building continues to be the chief activity, the most popular models built at the meetings arranged regularly for this purpose being Motor Cars, Lorries and Cranes. Interesting Lectures have been given on "*Electro-Magnetism and Dynamos*" and the "*York Railway Museum*," slides for the second of these being kindly loaned by the L.N.E.R. An attractive series of motor works visits has included inspection of the Trojan Works and of the A.E.C. factory at Southall. Club roll: 57. *Secretary:* M. M. Young, "The Corrie," Manor Way, Purley.

Chippenham Secondary School M.C.—Model-building Contests have been the chief feature of the programme of this recently affiliated club. The winning models are selected by popular vote, preference being given to those showing originality. Excellent papers on "*Aircraft*," "*Docks*," and "*The Petrol Engine and Aviation*" have been given by members. The Meccano display was the largest section in an Exhibition arranged by the Scientific Society of the School, the 38 models exhibited attracting special attention from the 300 visitors. Club roll: 22. *Secretary:* L. Stiles, Chippenham Secondary School.

Bagshot and Lightwater M.C.—A successful innovation was "Stranger's Evening," when each member was required to bring two friends with him. This event concluded with a Camp Fire gathering, and this is now a regular feature of meetings. More members are required and the secretary would be pleased to hear from Meccano boys in this district. Club roll: 13. *Secretary:* E. Hart, Providence Cottages, Guildford Road, Bagshot, Surrey.

Clacton and District M.C.—The club room has been improved by the work of members, and steady progress is being made. Novel Model-building Contests have been arranged, and at other meetings Debates have been held and a particularly interesting Lantern Lecture on "*Empire Air Routes*" has been given by the secretary. Enjoyable social events have included a successful "B.Y.O.G. Supper." Club roll: 15. *Secretary:* M. H. Carter, 12, Wellesley Road, Clacton-on-Sea.

Macclesfield Central School M.C.—The Exhibition was a great success, the model Dockyard built by members being specially attractive. After the Exhibition the Dockyard was greatly extended. It is now five yards in length and two yards in width, and the 20 model vessels in it include a representation of the "*Empress of Britain*." Special attention is being paid to bridge construction, and models of every type in use are being built. Club roll: 25. *Secretary:* V. G. Walmsley, The Bungalow, Higher Lane, Kerridge, Nr. Macclesfield.

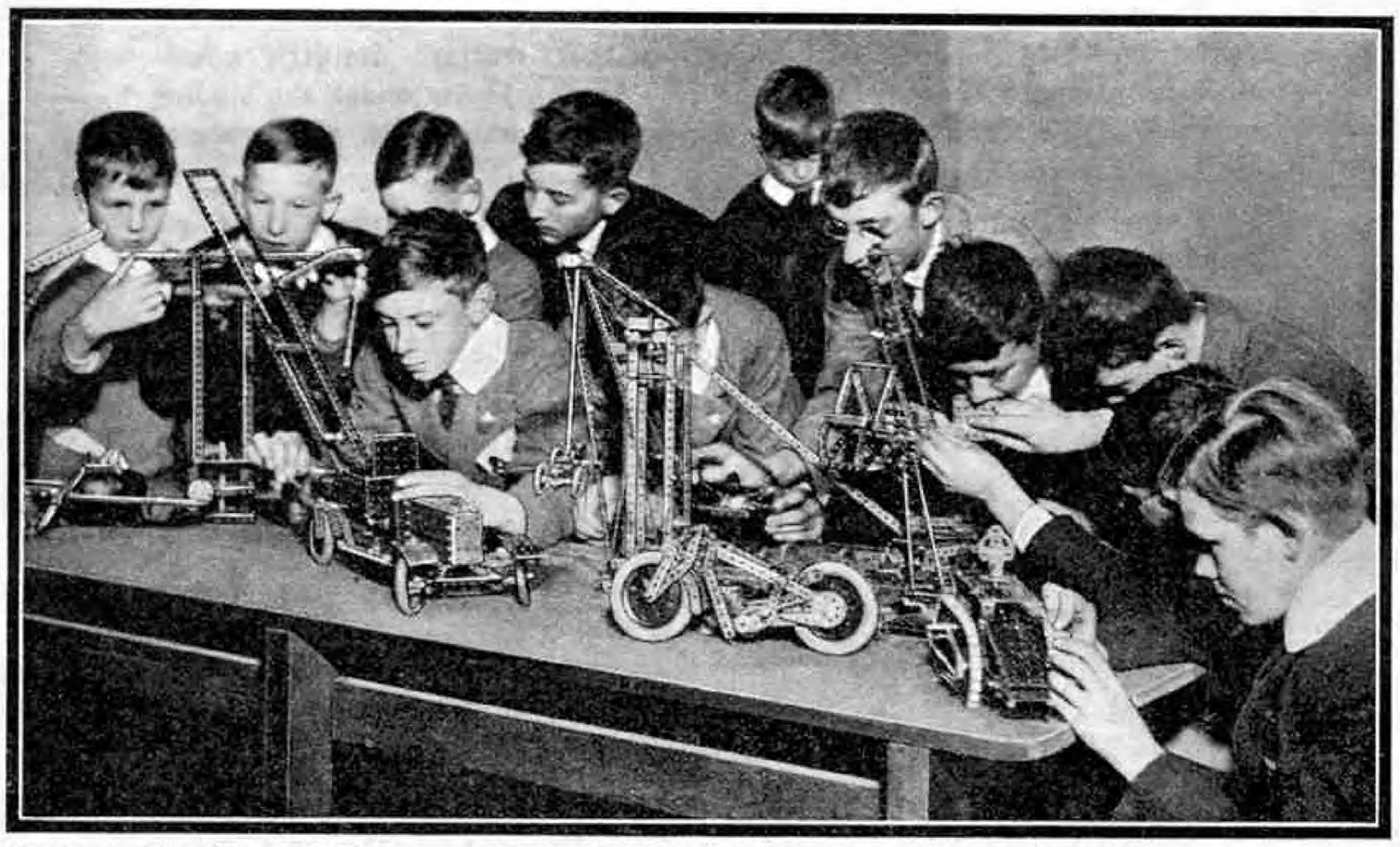
St. Peter and St. John's (Exeter) M.C.—Interesting recent models have included what is described as a 'crocodile" truck for carrying transformers. This has 16 wheels and is capable of negotiating curves of 1 ft. radius on the Branch track. A Winding Spool for dealing with the films exhibited by means of the club's projectors has been constructed. The extensive Workshop continues to be a centre of attraction. Club roll: 40. *Secretary:* Mr. J. Blaker, 60, Elmside, Exeter.

Sid Vale M.C.—Special evenings have been devoted to the construction of models of various types of Signals, Farm Implements, Searchlights and Weighing Machines. A popular feature of the programme is Model Carnival Night, when members design carnival scenes in which the figures and their surroundings are built from Meccano parts. Enjoyable Social Evenings have been arranged and a further attractive evening was a lecture on "*Foreign Stamps*" by Mr. F. M. Gliddon, Vice-President of the club. Club roll: 25. *Secretary:* R. Gliddon, Sheffield House, Sidmouth.

Hornsea M.C.—Recent meetings have included a Lantern Lecture on "*The Telephone*," after which telephone demonstrations in which members took part were given. Other Lantern Lectures have been given on "*Whaling*" and "*The Panama Canal*," and a talk on metal casting was illustrated by means of a film entitled "*From Pig Iron to Steel*." A special feature is made of games, most of which have been designed by Mr. R. W. Shooter, Leader of the club. Every member was required to make at least one model or prepare a drawing for the club's Exhibition, prizes being awarded for the best exhibits. The club's Hornby Train layout was a great attraction and interest also was shown in model-building operations in progress during the evening. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

Gatehouse M.C.—Members of various sections worked well in friendly rivalry during preparations for the recent successful Exhibition, at which the greatest attraction was the Hornby Train layout incorporating three stations and adequate lineside scenery. The Meccano exhibit took the form of a model of a coal-mining district, a miniature canal with model barges floating on it adding to the effect. The Exhibition closed with the presentation of a play by members, followed by Supper, and many interested visitors remarked that the evening passed too quickly. Club roll: 12. *Secretary:* G. V. Roebuck, Gate House, Ingatestone, Essex.

Old Charlton M.C.—A heated debate on "*Fireworks*" ended in a surprising decision, by a majority of one vote, that these are a nuisance! The unavoidable cancellation of a Lecture led a member to fill in the gap by an amusing impromptu story of the adventures of two convicts supposed to have escaped from Dartmoor. The first issue of "*The Meccanic*," the official magazine of the club, contains bright notes on club events, jokes and engineering news in addition to interesting articles. Club roll: 29. *Secretary:* B. Stevens, 53, Mount Street, Charlton, S.E.7.



Members of the Abington M.C. concentrating on the final adjustment of models constructed at one of their meetings. The Club was founded in March, 1932. Our photograph is reproduced by courtesy of the "Northampton and County Independent," which recently described the club in an interesting article, referring to it as "one of the most progressive social and educational clubs in Northampton."

AUSTRALIA

Melbourne M.C.—Models constructed by members were shown at a Carnival organised by a local Scout troop and proved a great attraction. A specially interesting programme of visits has been followed, members inspecting the projection room of a Picture House, the headquarters of the Melbourne Fire Brigade and the offices of the "*Herald*." At other meetings Lantern Lectures have been given on "*War Photography*" and "*Quaint Railways and Locomotives*," and members have demonstrated various super-models in addition to a Railway Station and an Electric Motor Testing Board. Club roll: 48. *Leader and Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

CANADA

Rosemount M.C.—Meetings continue to be held weekly, lunch being kindly provided by Mr. J. T. Favelle, Leader of the club, and visitors are always welcome. The profits on the club's successful Exhibition are to be devoted to a camping trip during the summer holidays. A further display of models has been given in Rosemount Church, proceeds being in aid of charity. Mr. L. Wilkinson, Vice-President of the club, has built a Meccano Loom driven by an electric motor. This has aroused so much interest that Mr. Wilkinson has been asked to demonstrate its working at four important schools in Regina. Club roll: 29. *Secretary:* J. Watson, 974, Athol Street, Regina, Sask.

GERMANY

Berlin M.C.—Members have been busily engaged in constructing a model of the Ship's Elevator at Niederfinow. The prototype is employed for transporting barges and similar vessels to a higher level on the Berlin-Stettin Canal, and its design is being closely followed in the model. The movements of the lift are to be controlled automatically. Club roll: 13. *Secretary:* H. Kobrak, Alt Moabit 83 c, Berlin.

NEW ZEALAND

Christchurch M.C.—In company with members of the Fendalton and Summer Clubs, the Godley Head Lighthouse was visited and at the next meeting a Lantern Lecture on "*Lighthouses*" was kindly given by Mr. Morrison, who supplies illuminating gas for use in many New Zealand lighthouses. Other visits have been paid to the New Zealand Railway Workshops at Addington and to the Signal Cabin at Addington Junction. Visits have been exchanged with other Meccano clubs in Christchurch and district, and the resulting discussions on programmes and Guild matters generally have been helpful. A Lecture on "*Signals*" was given by Mr. Moyle, who demonstrated the uses of various types with the aid of signals in the Hornby Series. Club roll: 32. *Secretary:* E. A. Gay, 625, Colombo Street, Christchurch.

SOUTH AFRICA

Western Province (S.A.) Preparatory School M.C.—Model-building continues to be carried on with great enthusiasm, and a second Exhibition has been held. This was opened by Mr. Cain, of the U.C.T. Engineering Works. The models on view included a Fairground in which were a Roundabout, a comic Orchestra and Sideshows contributed by various members, a model engine, a "Sandes-Smuts" Motor Charabanc that carried a mascot, and many Aeroplanes. A Hornby Train layout was in active operation. The proceeds amounted to £1-1s.-3d. The club has now been affiliated to the Guild. *Secretary:* P. K. Wiener, Balcairn, Eden Road, Claremount, C.P.

Club Not Yet Affiliated

St. Edmund's (Bristol) M.C.—The present session began with an enjoyable New Year party at the house of Mr. White, President of the club, when the Leader gave a talk on the value of Meccano. Other meetings have been devoted to Model-building. Members are constructing a model Dockyard. The woodwork for this has been completed and models of Ships, Tugs and Cranes have been built for inclusion in the layout. A Hornby Railway also forms part of the scheme. Application is to be made for affiliation. *Secretary:* N. Hewett, "Hightorpe," The Crescent, Henleaze, Bristol.

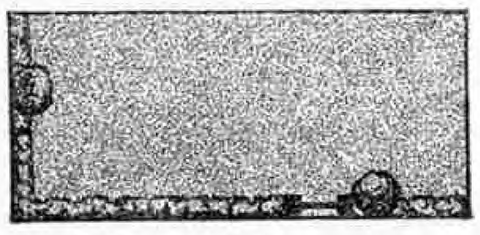
Hornby Series
For 2-ft. radius layouts only.

HORNBY

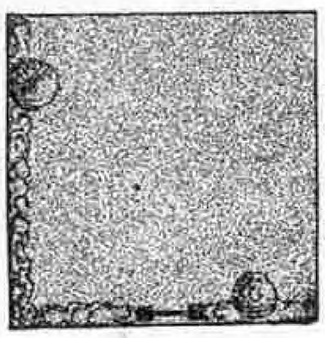
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COUNTRYSIDE SECTIONS

Add the Final Touch of Realism!



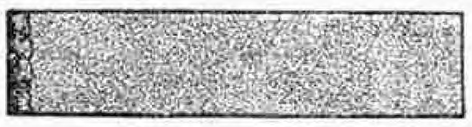
J1



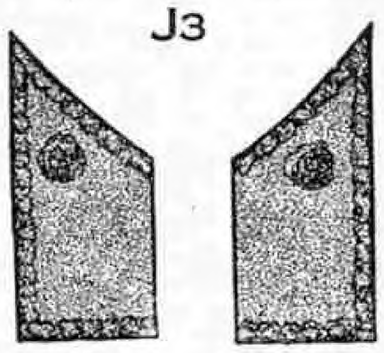
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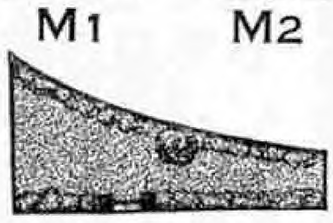
R



J3



M1 M2



L1

The final touch of realism is added to your model railway by the use of the new Hornby Countryside Sections. These attractive accessories mark a new departure for miniature railways, and enable a system to traverse most natural surroundings in a manner that has hitherto hardly been possible, except on the most elaborate permanent layouts. Splendid scenic effects may be obtained by arranging the Countryside Sections round a layout, and inserting here and there the Hornby Miniature Animals (Modelled Miniatures No. 2).

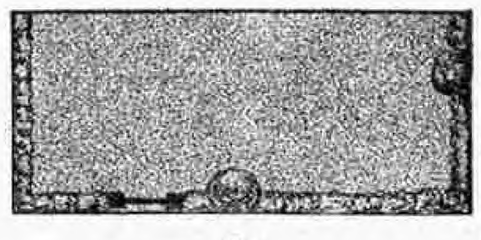
The Sections G1 and G2 are used along the inner edges of a plain circular track, the space enclosed by them being filled by the square F Sections. If an oval is made by adding straight rails, Sections J1 and J2 are laid across the space between the two halves of the circle, their number corresponding to the number of rails added.

The No. 1 Level Crossing necessitates the use of road Section H, the breadth of which is equal to the length of the Crossing. Similarly a half-rail requires the narrow field Section J3. Section H fits under the sloping approach of the Crossing, and a packing piece R is used on the opposite side to preserve the level.

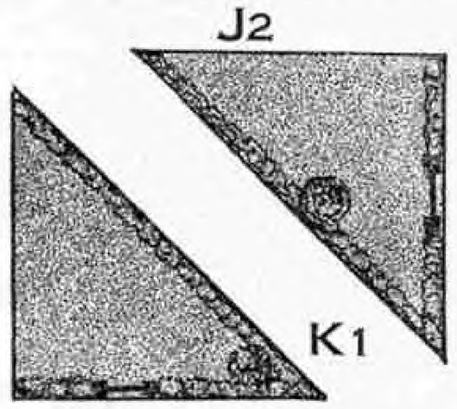
Triangular Sections K1 and K2 fit between the arms of the Right-Angle Crossing, so that "figure eight" layouts can be easily made up.

Curved Sections L1 and L2, and M1 and M2, are available for the outer edges of the track, the straight parts being edged by Sections J1 and J2, or J3.

A striking illustration showing how the Hornby Countryside Sections, Cuttings, and Tunnels may be applied to a layout is given below.



J2

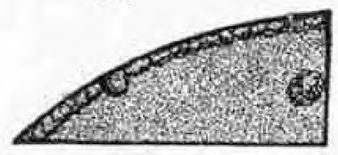


K1

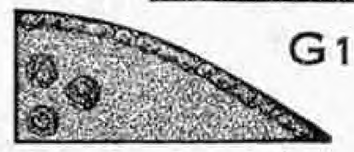
K2



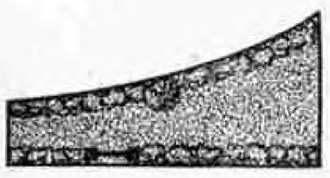
H



G1



G2



L2

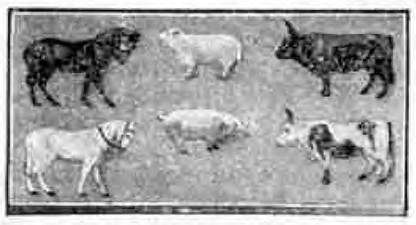


MODELLED MINIATURES No. 13
HALL'S DISTEMPER ADVERTISEMENT
This miniature of a well-known lineside advertisement is intended to be placed in the fields adjoining the railway track. **Price 9d.**

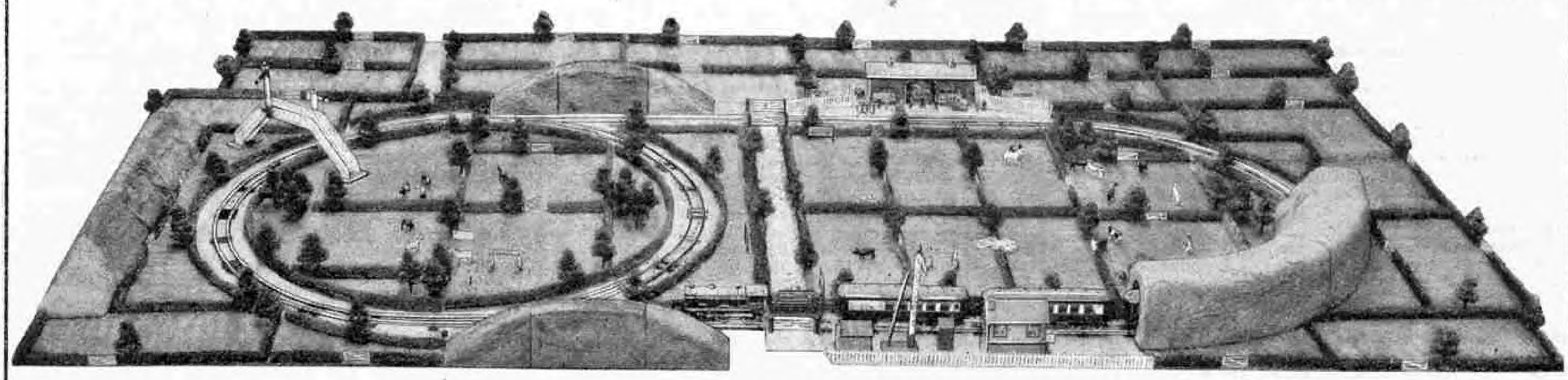
ASK YOUR DEALER TO SHOW YOU THE NEW
HORNBY COUNTRYSIDE SECTIONS

PRICE LIST OF COUNTRYSIDE SECTIONS

Fields F ...	... Box of four	**10/-**
Fields G1 and G2	... Box of eight (four G1 and four G2)	**11/-**
Roads H and Supports R	... Box of two H with two R Supports	**5/6**
Fields J1 and J2	... Box of four (two J1 and two J2) ...	**11/-**
Fields J3 ...	... Box of two	**2/-**
Fields K1 and K2	... Box of four (two K1 and two K2) ...	**8/-**
Fields L1 and L2	... Box of four (two L1 and two L2) ...	**7/-**
Fields M1 and M2	... Box of four (two M1 and two M2) ...	**5/-**



MODELLED MINIATURES No. 2
FARMYARD ANIMALS
Comprises six animals—Sheep, Pig, two Cows, and two Horses.
Price per set 1/6



MECCANO LTD. – BINNS ROAD – LIVERPOOL 13



Branch Notes

1ST BIRKENHEAD.—The proceedings of this newly-incorporated Branch began with a survey of available locomotives and rolling stock, and trials are being made of suitable layouts. Mr. D. A. Miller, Chairman of the Branch, has given a talk on "*Signalling*," and this has resulted in improved signalling work during track operations. A Lantern Lecture on "*Britain's Largest Railway*" has been given, slides being kindly loaned by the L.M.S.R. Visits to the G.W.R. Engine Sheds and to various stations have been arranged, and regular notes on locomotives working in the district are being compiled. Secretary: W. W. Aslett, 91, Prenton Road East, Prenton, Birkenhead.

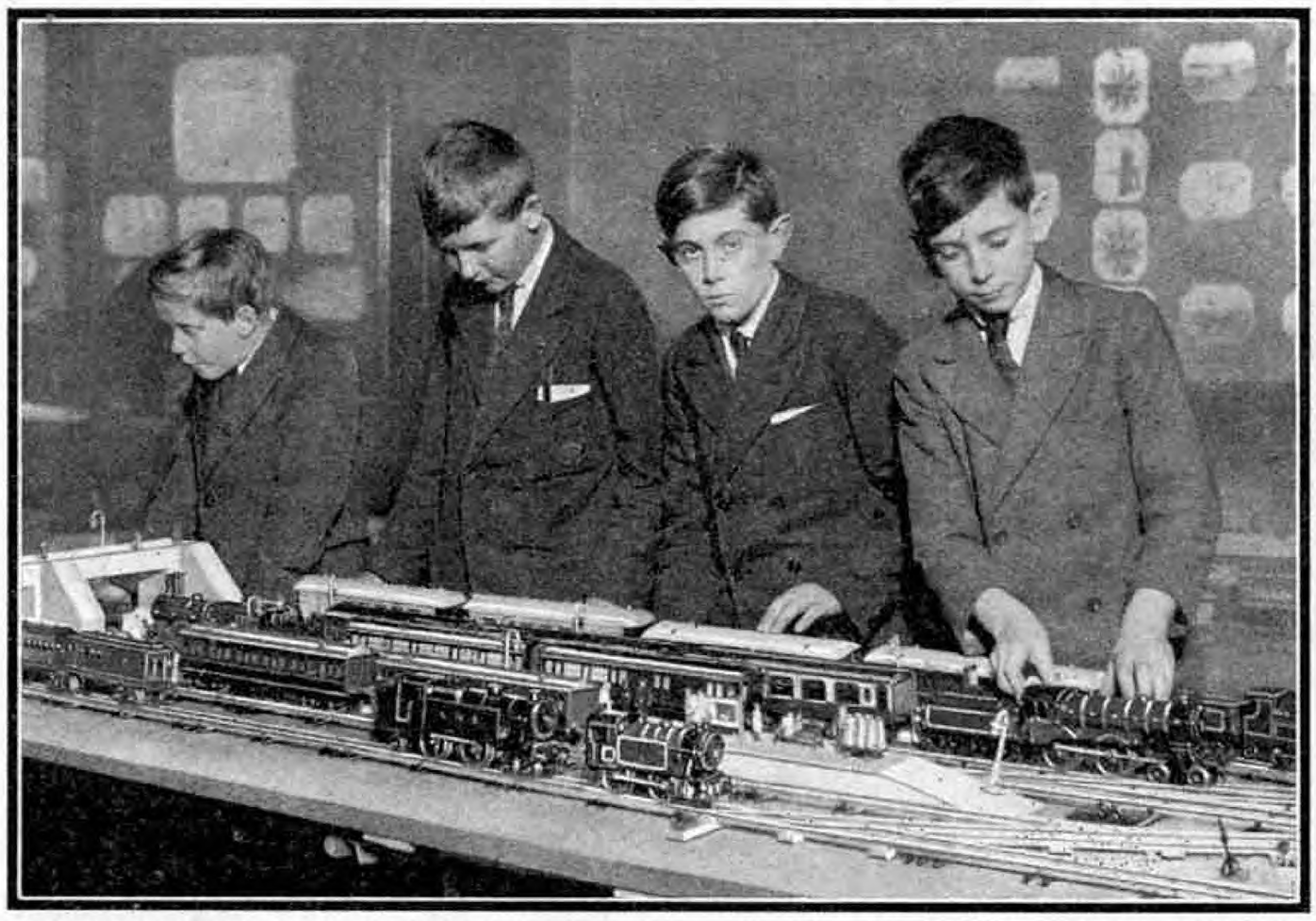
STREATHAM PARK.—The Branch layout has been improved by the addition of further accessories, and new timetables have been prepared. Track operation is very successful. Great stress is laid on punctuality, reports on the causes of delays being called for. The S.R. electrification scheme has aroused great interest and a visit has been paid to Victoria Station in order to inspect the new electric trains. An enjoyable afternoon was spent at an Exhibition arranged by the Streatham Common Branch. Secretary: P. J. B. Doyle, 177, Ribblesdale Road, Streatham, London, S.W.16.

BLACKPOOL (NORTHERN SECTION).—A heated garage has been adapted for use as a Branch room and interest in track work has been renewed. Trestles 3 ft. in height have been erected on which to fix the track, and members have been busily engaged in planning the layout and in general construction work. Three sections representing the L.M.S.R., L.N.E.R. and G.W.R. respectively have been formed. One night a week is being devoted to track work, but members visit the Branch room practically every evening. Secretary: A. F. Gregson, 254, Caunce Street, Blackpool.

CATERHAM SCHOOL.—A special feature has been made of open meetings at which Lantern Lectures are given, and these have attracted audiences of over 100. The lectures have included one by Mr. K. C. Sparrow, President of the Branch, on "*How Tube Railways are Built*," and a talk on "*The Southern Railway*," by Mr. L. W. Aldridge. Other subjects dealt with have included a description of the Trans-Australian Railway. Secretary: G. J. H. Dent, Caterham School, Caterham, Surrey.

STREATHAM COMMON.—The Junior section has held successful track meetings. Each member is assigned a section to keep in order and it is a rule of the club that every locomotive available should be given duty in turn. An open meeting at which various competitions were arranged attracted so many visitors that the Branch room was uncomfortably crowded. In the Senior section talks on railway topics have been given by members, and excellent track meetings, locomotive speed contests and socials have been arranged. Great preparations have been made for the Second Annual Exhibition, to be held on 28th and 29th of this month. Secretary: N. L. Bamford, 104, Pathfield Road, Streatham, S.W.

COBHAM (ST. ANDREW'S CHURCH).—Special attention is being paid to the requirements of junior members. Simpler layouts have been arranged and members are encouraged to take part in planning operations and arranging timetables. This has led to the development of more initiative, and promises well for future meetings. Secretary: A. E. J. West, "Fernlea," 13, Freelands Road, Cobham, Surrey.



A group of members of the Maidstone Branch, No. 142. Chairman, Mr. C. Wicks; Secretary, W. Hills. This Branch was incorporated in October, 1930, and has made splendid progress. Our photograph, reproduced by permission from the "Kent Messenger," shows a section of the Branch track on view at the recent Exhibition, which attracted nearly 800 visitors.

AUSTRALIA

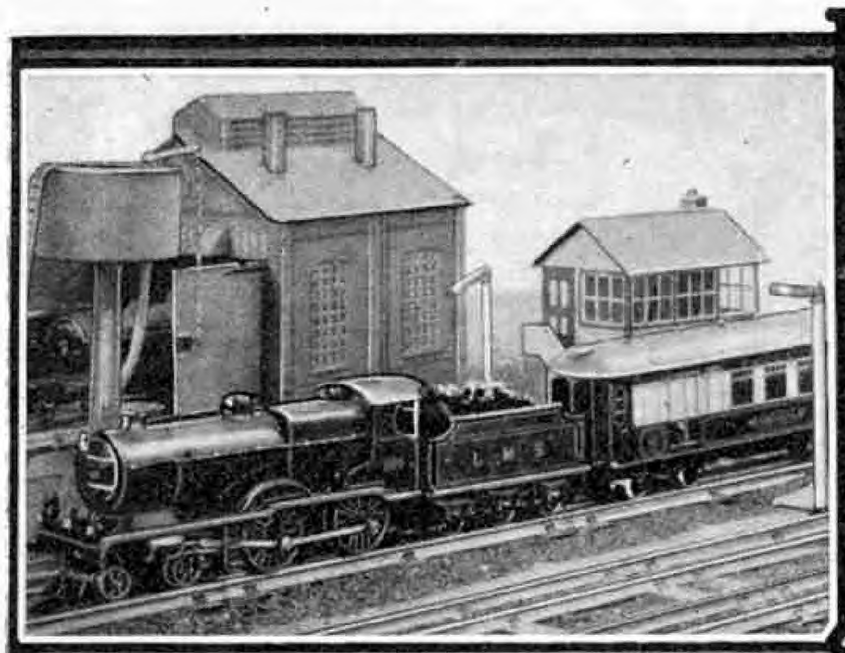
PARRAMATTA.—The Branch track represents the section of the G.W.R. line from Barmouth to Pwllheli. It is laid down on a strong framework held together with nuts and bolts, and stations are fixed to a baseboard made in sections for bolting on the framework. Electric lighting is being installed in the buildings. Electric colour light signals are to be introduced and a turntable is now under construction by members. Secretary: H. H. Matthews, 27, Ross Street, Parramatta, N.S.W.

SYDNEY.—The Branch celebrated its First Birthday with a Social Evening at which games were played. An account of the new Pt. Kembla–Moss Vale Railway was given by Mr. H. H. Matthews, Chairman of the Branch. Additions to the layout include new points and a station that is to be given a name when it is opened officially. A magazine known as the "*Sydney Meccomag*" is being produced, and it is hoped that exchanges will be arranged with other clubs producing journals of this kind. The Mayor of Petersham presided at the Annual Meeting, and after reports had been read, films kindly loaned by the representatives in Australia of the L.N.E.R. were shown. Secretary: W. J. T. Watson, 595, Parramatta Road, Leichhardt, N.S.W.

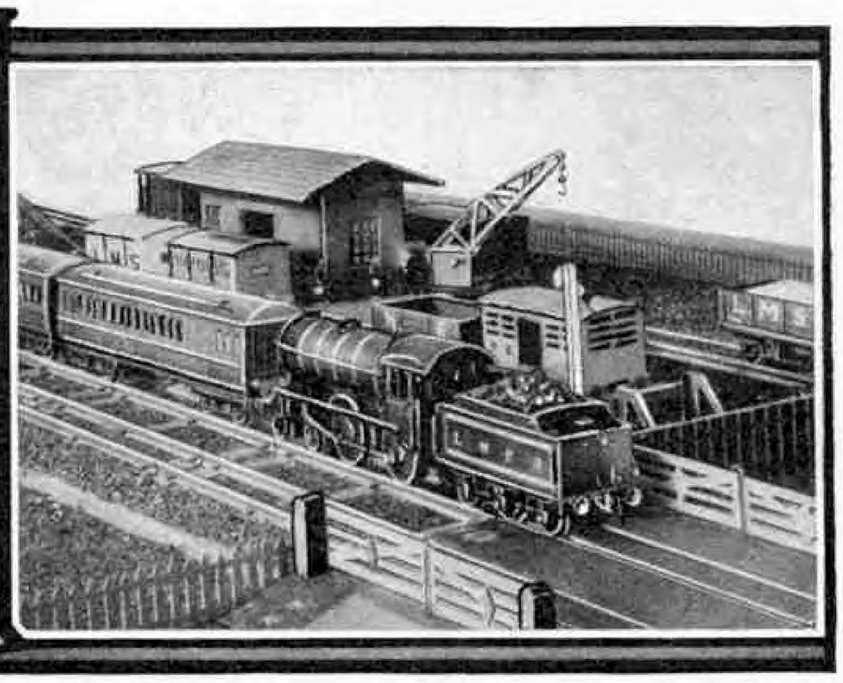
Proposed Branches

The following new Branches of the Hornby Railway Company are now being formed, and boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership, and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

ABERDEEN—T. Bruce, 332, Hardgate.
BECKENHAM—J. Roszak, 72, Beckenham Road.
BRISTOL—N. Hewett, "Hightorpe," The Crescent, Henleaze.
CANADA—Mr. Nye, 66, Gray Avenue, Toronto.

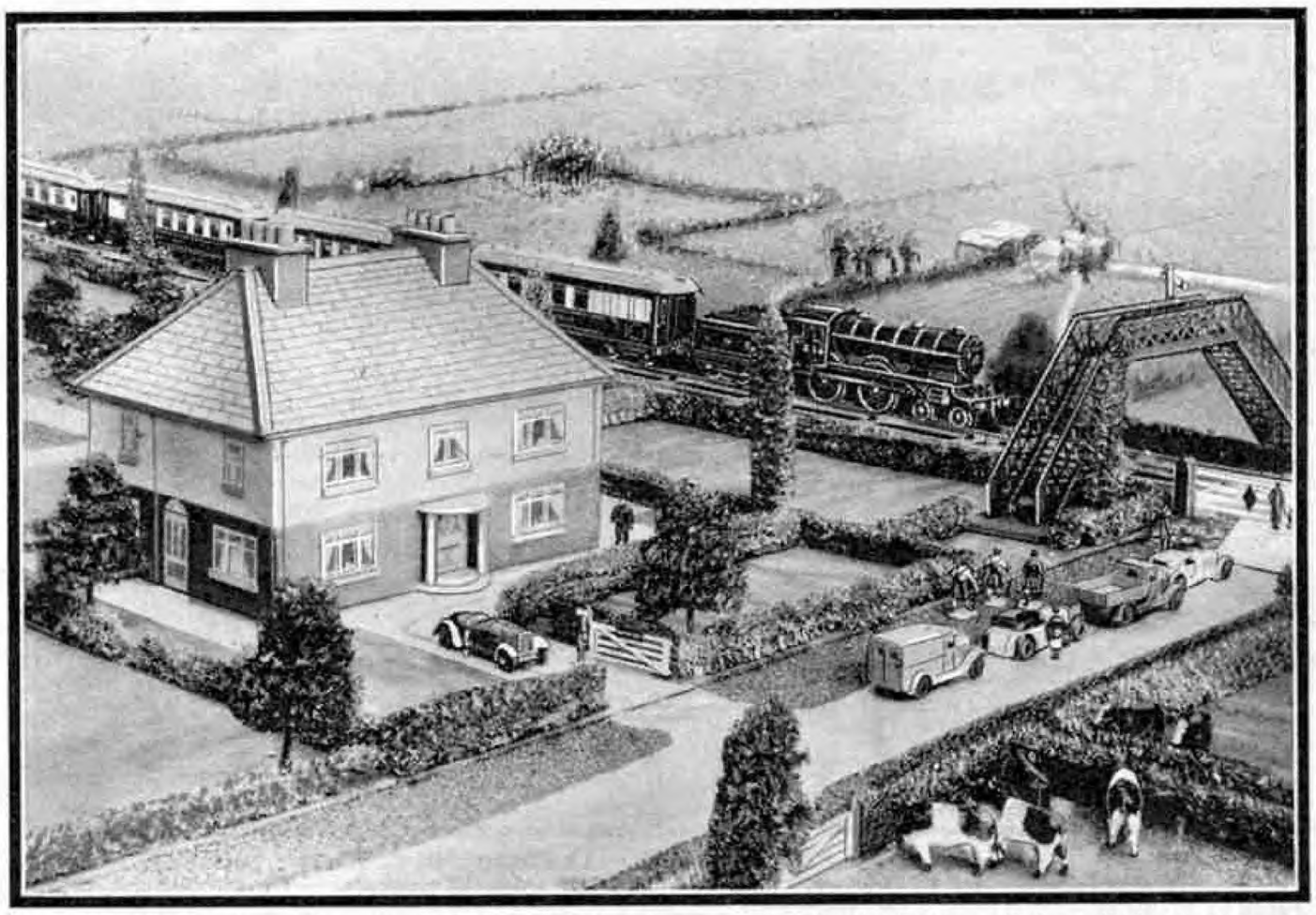


HOW TO GET MORE FUN FROM HORNBY TRAINS



LIV.—PASSENGER TRAIN OPERATION

FROM time to time we have included in these articles hints on the reproduction of particular features of the practice of the various railways. These have referred to the locomotives used, the chief kinds of traffic conveyed, the vehicles normally employed, and similar details. The assembly of various items of miniature rolling stock in order to reproduce famous expresses of actual practice is of particular interest. Many of these trains are remarkable for their varied character, not only as regards the ownership of the vehicles that compose them, but also their types and sometimes their functions. Some general considerations regarding the various types of passenger trains that it is possible to run on Hornby railways will therefore be of interest.



Complete Pullman trains form the most important expresses in the Hornby Series. This realistic photograph shows an all-Pullman express approaching a level crossing, while road traffic is held up for the train to pass.

In actual practice the number of coaches composing a train is more or less constant but fluctuations of traffic occur, especially at holiday times, and then additional vehicles may be required over and above those normally making up a particular train. The extra traffic may be of such an extent that a particular service has to be duplicated, the train being then run in two portions, consisting perhaps of the maximum number of coaches and leaving within a few minutes of each other. Even then such a rush may be experienced that further portions or relief trains have to be run. In general, however, various sets of vehicles are allocated to certain services, and these are kept assembled ready for use and are only disturbed when repairs become necessary to a particular unit. Time is saved when they are required for service, as there is little or no shunting involved in making up the train.

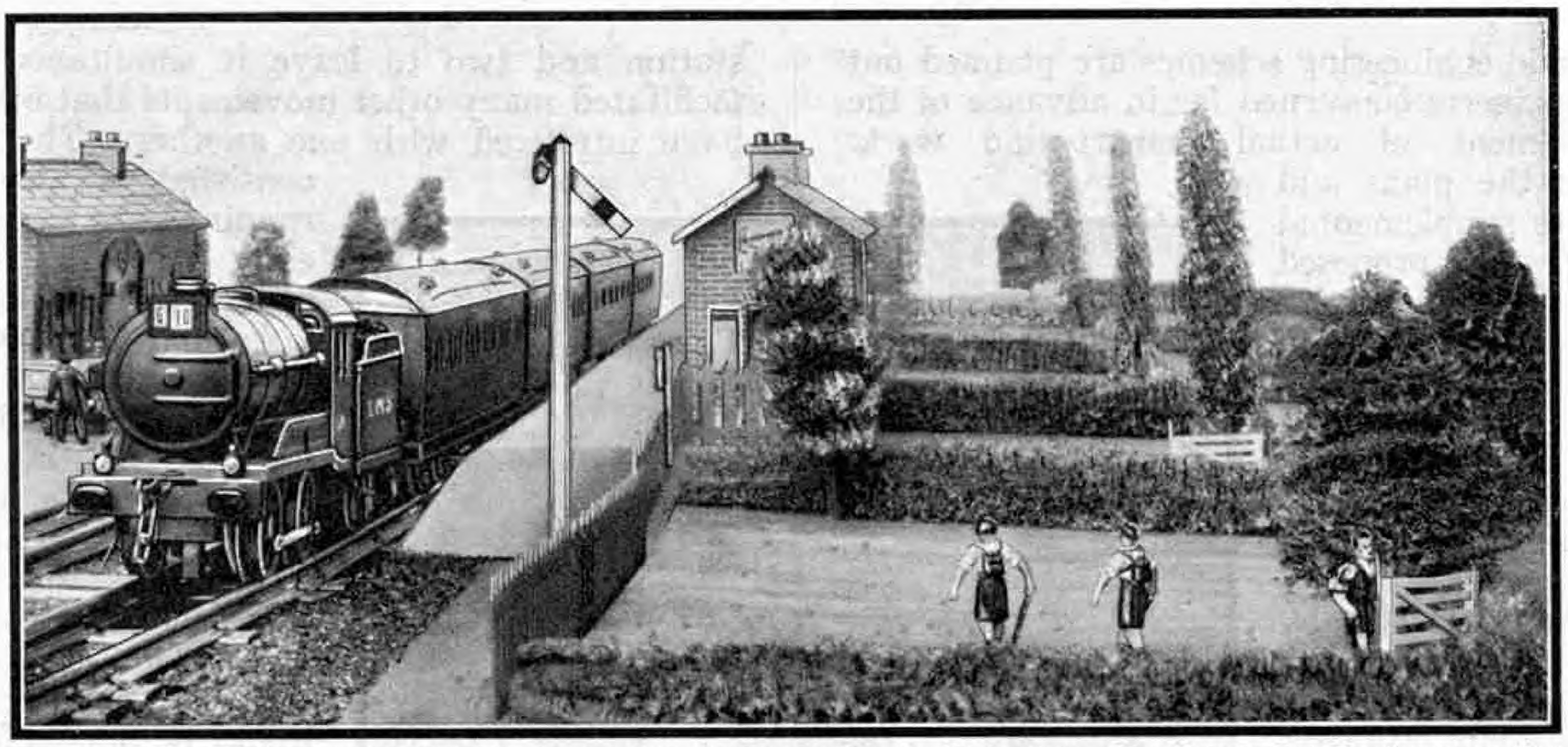
On miniature railways this set train principle is often employed for several reasons. The resources of the line in the matter of rolling stock generally do not allow of the assembly of trains of extreme length. Station and siding accommodation are frequently restricted, and the locomotives have limited power, especially where clockwork is employed. Trains therefore must be of such a length that they can be easily stored in the sidings or accommodated at the platforms. It is desirable that the locomotives should have a sufficient reserve of power to deal with any additional vehicles, such as a Guard's Van, Luggage Van, or Milk Van, that may have to be attached. A more or less constant formation of coaches is therefore the rule for each particular service that has to be provided.

The set train scheme is very useful for suburban services, and where No. 1 Coaches are employed it is an advantage to assemble them in close-coupled set trains, as suggested in the "*M.M.*" of last May. There is no need for any shunting, as they may be brought into use as complete units, and if they are close-coupled a certain amount of space is saved. This saving is valuable in miniature terminals, where the length of track between the crossover points of "run-round" loop roads is often severely limited. In such trains as these, that may be operating return services between two terminals, the placing of a Guard's Van at each end is essential, so that the train may be complete when running in either direction. It is convenient, where two or more sets are in use, to number or letter them, especially if timetable working is practised, so that particular sets may be readily identified. A more interesting scheme is to name them according to the station or depot to which they are attached, or the district in which they work.

It is interesting to consider the various types of passenger trains that it is possible to assemble with the different vehicles in the Hornby Series. Pride of place must be given to the No. 2 Special Pullman Coaches, which have a very realistic appearance and are remarkable

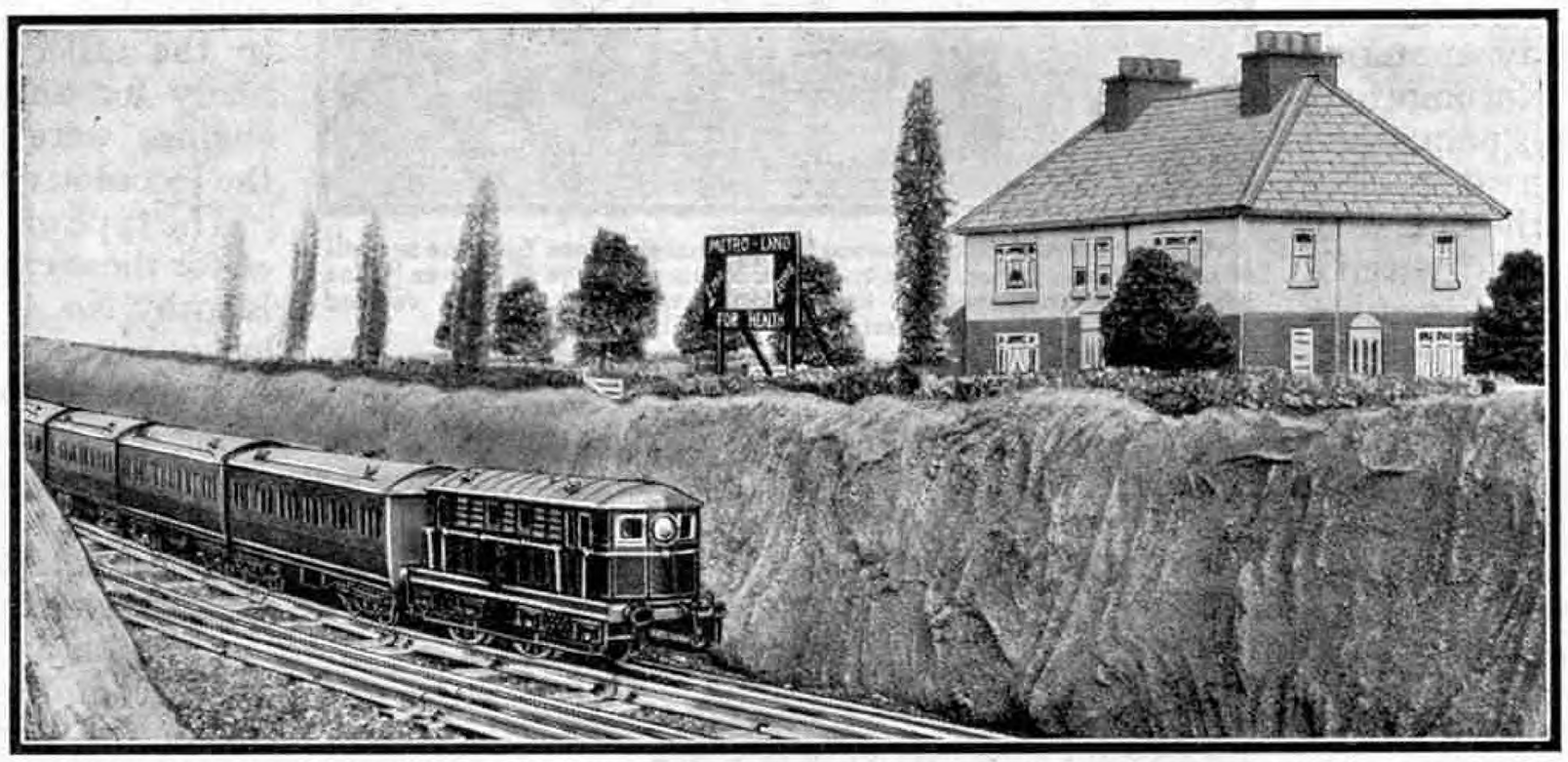
for their smooth and easy running qualities. There are two types, the ordinary Coach and the Composite, so that complete Pullman trains may be made up of a convenient number of vehicles, a Composite Coach with guard's and luggage accommodation being attached at each end. Well-known all-Pullman trains of actual practice may be represented, such as the "*Golden Arrow*" of the S.R., or the "*Queen of Scots*" of the L.N.E.R.

But there is no reason why imaginary names should not be made up by individual model railway owners to suit the requirements of their own systems, and many readers find that original practices of this kind are particularly attractive. On a layout serving an imaginary stretch of country, various features selected from the individual practice of the four great groups may be adopted.



A special train passing a country station situated amongst Hornby Countryside Sections. The Metropolitan Coaches composing the train are very useful for general purposes as suggested in this article.

Less elaborate but very satisfactory are the No. 2 Pullmans, and the similar No. 2 Saloon Coaches in L.M.S.R. and L.N.E.R. colours that represent the centre-corridor stock of both these systems. Complete trains in each case may be assembled, but as corresponding composite coaches are not available, accommodation for luggage and the guard may be provided by the attachment of No. 1 Guard's Vans. These vehicles, which are of course four-wheelers, are quite satisfactory and surprisingly useful. Although the No. 2 Pullman and Saloon Coaches run on bogies, the effect of using the two types in conjunction is quite pleasing and has a certain amount of novelty about it. For the L.M.S.R. and L.N.E.R. Saloons, the Guard's Vans in corresponding colours should be used.



A realistic scene on a Hornby Metropolitan layout. The electric train shown is typical of those employed in the residential services of the Metropolitan Railway in actual practice.

Those who employ No. 2 Pullmans may use G.W.R. Guard's Vans, for the colours of these are very similar to the brown and cream of the Pullmans. The attractive Composite No. 1 Pullmans may be used instead, and as they are of characteristic construction with end vestibules they are particularly suitable.

For layouts of simple character and in more or less confined spaces, but where 2 ft. radius rails are in use, the No. 1 Pullmans have much to recommend them. They reproduce on a somewhat smaller scale all the characteristics found in the larger Pullman vehicles, and as they are four-wheelers a train of them does not take up much space. As both ordinary Coaches and Composites are available, they have possibilities in the way of train formation similar to those of the No. 2 Special vehicles.

The No. 1 Coaches and Guard's Vans have already been dealt with in connection with suburban services, but they may form the express trains of less ambitious types of miniature railway systems, where only the smaller engines of the Hornby Series are in use. Similar remarks also apply to the smallest Pullman Coaches. They are quite satisfactory for their purpose, and enable suitable "luxury expresses" to be run on even the smallest Hornby layouts.

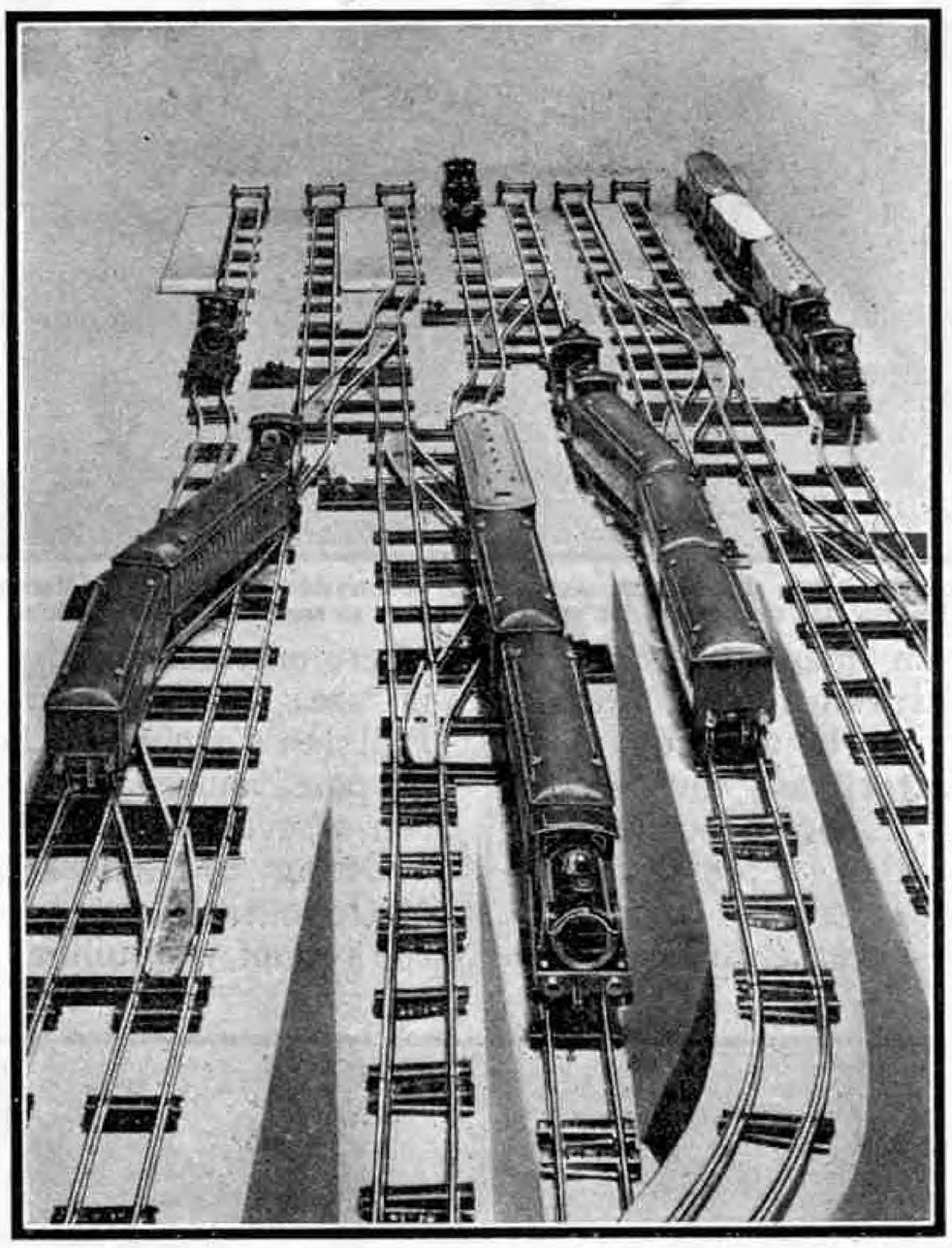
Owing to their individual character, the Hornby Metropolitan Coaches are better considered apart from the rest of the rolling stock of the Series. They are of the compartment type, and their essential purpose is to make up the through trains that are run to and from the City and the country districts served by the Metropolitan line. Steam locomotives are used for part of the journey in the open, but the electric engines take charge for the remainder of the run. The Hornby Coaches supplied in the electric Metropolitan Sets are arranged to be illuminated inside, and they then look very fine when running, but the ordinary variety, as found in the clockwork Metropolitan Sets, are not so fitted. The Metropolitan Coaches as a type are particularly useful for general purposes on a miniature system. Their employment as L.N.E.R. vehicles, owing to the similarity of the colours, has often been suggested in these pages, and is taken great advantage of. Ordinary and composite coaches are made for both clockwork and electric systems.

Argentine Railway Uses Hornby Material

Planning the Layout for a Great Station

ALL large-scale engineering schemes are planned out by the engineers concerned far in advance of the commencement of actual construction work. In many cases the plans and specifications are supplemented by models of the proposed structure, or of sections of it; and in recent years Meccano has been widely used for building such models. It has proved perfectly successful for this purpose, and has thoroughly justified its claim to be "Engineering in Miniature." It is interesting to find that Hornby Railway material is now being used in a similar manner to assist in the solving of problems in railway engineering.

Some time ago one of the leading Argentine railway companies decided to build a great new passenger terminal station. Several alternative layouts for this station were put forward, and in order to examine thoroughly the working possibilities of the different schemes the engineers of the line made use of Hornby Railway material, including tank locomotives, Pullman cars, rails, points and crossings, and a great variety of accessories. In the course of experiments with this material many fascinating operations were carried out that would have delighted the heart of any boy, and particularly of a Hornby Railway enthusiast.

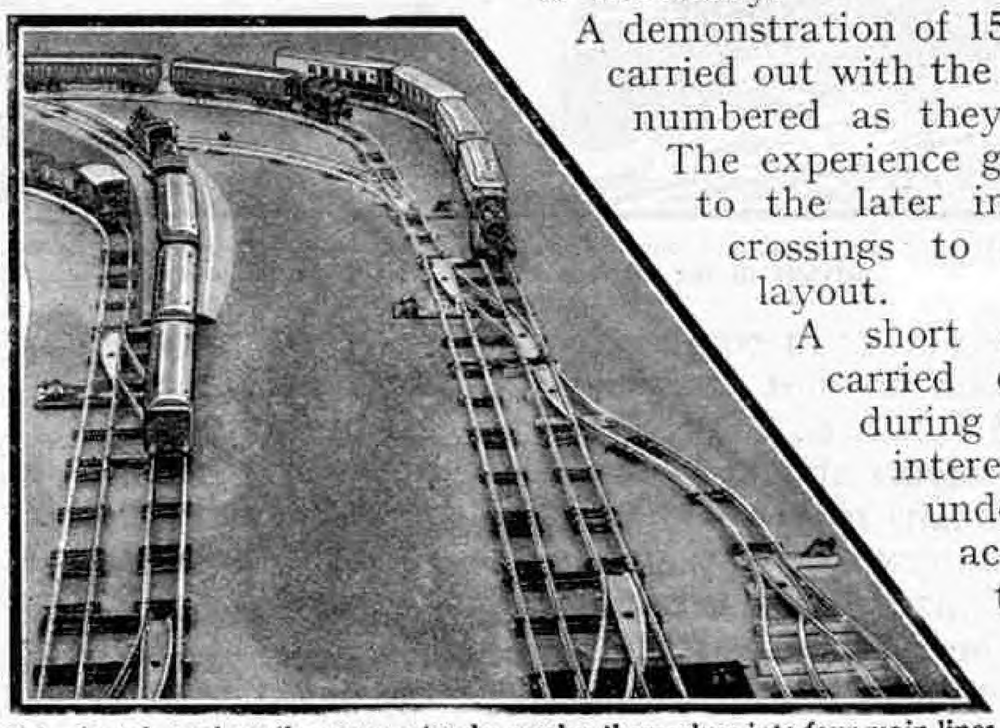


A view of the layout looking toward the terminal platforms from the summit of the "fly-over" line. The train descending from the "fly-over" line has crossed over the path of the departing train, but without causing any interference to the latter.

The first experimental scheme made provision for six platform lines, and one up and one down main running line, together with locomotive and carriage sidings. The second scheme entailed eight platform lines as shown in our diagram, and two up and two down main running lines placed alongside each other, locomotive and carriage sidings being included also. In this scheme trains from one of the in-going lines gained access to five of the eight platform lines by means of a "fly-over" line built up on an embankment and viaduct. The introduction of this "fly-over" line permitted two trains to enter the station and two to leave it simultaneously. It also facilitated many other movements that otherwise would have interfered with one another. The third scheme consisted of two down main running lines placed alternately, eight platform lines, and locomotive and carriage sidings.

To find out how many trains could be dealt with in one hour on each layout, diagrams were prepared showing the probable density of traffic on the running lines and platform roads of the projected station. In some cases the engines were "stepped." That is to say an engine that had brought in one train would be uncoupled and would wait at the buffer stop until its train was drawn out by another engine; it would then follow the train out, back on to the head of a train at another platform, and depart with that. In other cases the engine, after bringing its train in, would be uncoupled, run round the train by way of an adjacent road, and backed on to the other end of its train, ready for another run. Other engines were brought in from the locomotive shed as required.

The type of locomotive adopted for these experiments was the Hornby No. 1 Tank, and eleven locomotives of this class were used. These locomotives were considered specially suitable owing to their being very easy to handle for intensive working, and to the fact that no turning is necessary.



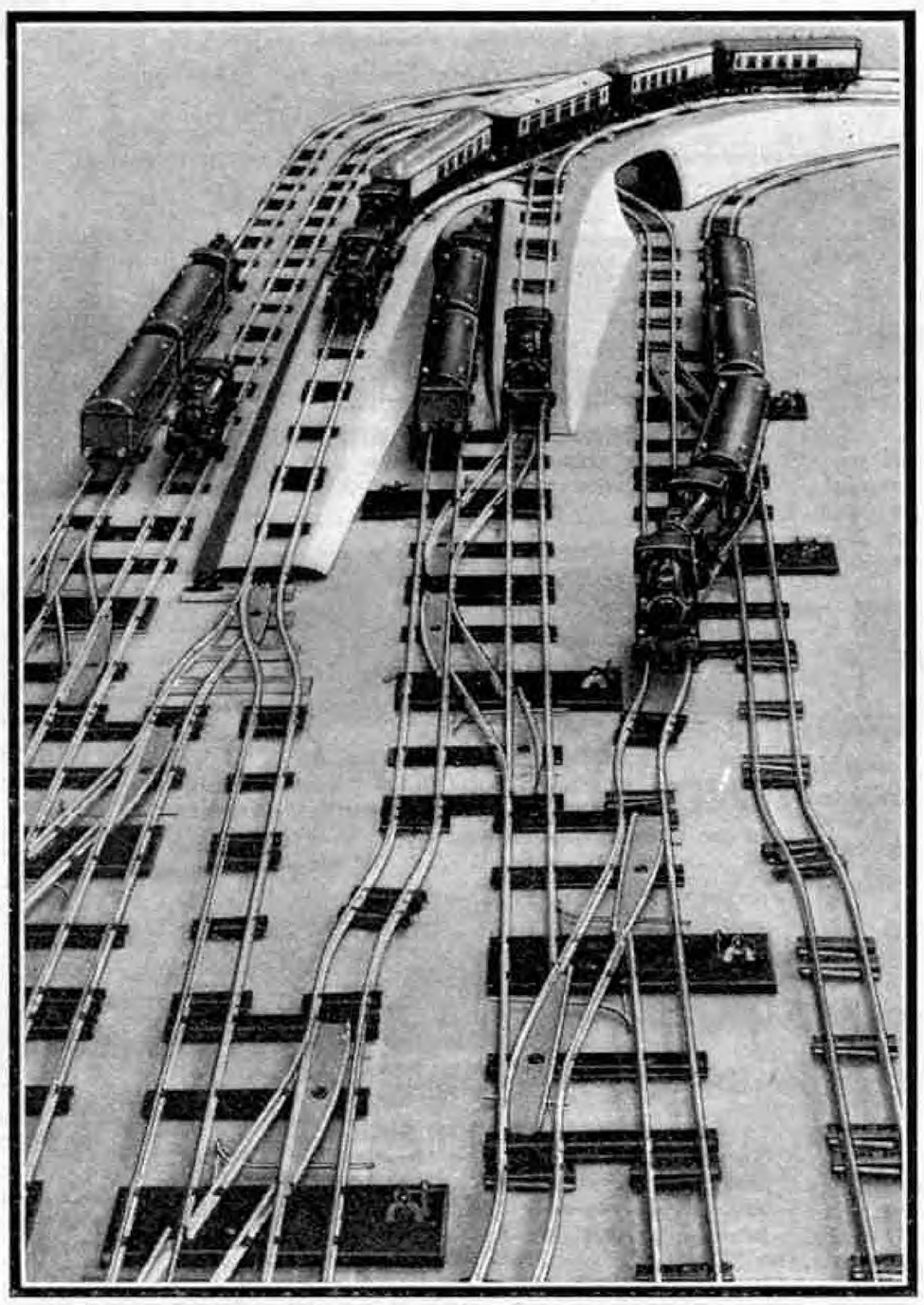
This view shows how the various tracks resolve themselves into four main lines, and is taken from the outer end of the approach to the "fly-over." The sidings on the extreme right lead to the locomotive depot.

A demonstration of 15 minutes intensive working was carried out with the second scheme, the points being numbered as they would be in actual practice. The experience gained from this experiment led to the later inclusion of further points and crossings to simplify the working of the layout.

A short description of the operations carried out with the second scheme during the first five minutes will be of interest to readers, and will be easily understood by reference to the accompanying diagram. The station at the outset was occupied as follows. In platform 4 a train was standing with engine at the buffers; and in platforms 3, 5 and 7 trains were

standing with locomotives at each end. A train approached the station on line A, and entered platform 2 by means of crossover 2. Simultaneously a train left platform 5 and proceeded via crossover 6 and road X2 on to the running line X. A train from line B entered platform 6 via the " fly-over " line and road B2. Simultaneously an engine ran from platform 5 via crossover 6 and backed on to a train in platform 4. A train left platform 3 and proceeded via crossover 3 and road X1 on to the running line X. A locomotive proceeded from platform 3 via crossover 3 and backed on to a train in platform 2. A train from line B entered platform 5 via line B2. Simultaneously a train left platform 7 and proceeded via crossover 10 on to the running line Y. An engine from platform 3 proceeded via crossover 3 and backed on to a train in platform 2; and an engine from platform 7 proceeded via crossover 9 to platform 6.

In actual practice many of the points used in the experimental layout would be replaced by double crossovers, together with single and double slip crossings. The addition of these latter would considerably reduce the amount of space required, and also would facilitate the rapid movement of locomotives and trains, especially when any shunting operations are being carried out in preparing trains or in disposing of them.



The " fly-over " line as it appears from the station platforms. From left to right the various lines are occupied as follows. An express train departing; a tank locomotive waiting to couple on to a train; a train traversing the " fly-over " headed by two locomotives, while underneath it there passes another departing train. Then there is a locomotive waiting to enter the station, and finally another arriving train.

Our photographs show views of the model layouts, which were 30 ft. in length and 3 ft. in width, being laid down on drawing tables round the sides of a room. Necessarily the layout had to be curved at the wall angles, but in actual practice of course these curves would not appear or would be considerably modified.

It will be noticed that signals were excluded from the experimental layouts. The signals in the actual station will be of the colour - light type, and the points will be operated by power. Signals of this kind are now greatly favoured by railway engineers, and there is no doubt that they have many advantages over the semaphore type.

It is specially interesting to learn that the engineers were so delighted with their experience of Hornby Train material in these experiments that the engines, rolling stock and track have been retained for similar experimental work in future, and for use when it is necessary to demonstrate movements that can be made on existing tracks, and to illustrate certain rules and regulations connected with railway operations.

Although the great size of this layout will prevent most Hornby enthusiasts from experimenting with it as it stands, there will be many who will obtain ideas for their own railways from the track diagram of the second scheme. There are one or two points that are not brought out clearly in the illustrations and diagram, however, and the following suggestions will be useful to those who wish to work on similar lines. The gradient of the " fly-over " line must not be too steep, or the locomotives will be liable to slip. The locomotive shed and carriage sidings should be placed on the left-hand side of the tracks on leaving the station. One of the crossovers from X to Y and one from A to B should be omitted, and one inserted between X and B instead, the exact details depending on the extent to which the original characteristics of the layout are reproduced. The incorporation of a " fly-over " line or " flying junction " would be a novel feature in miniature practice, but one well worth while the trouble taken in experimenting and in installation. It requires of course a considerable amount of space to obtain the fullest benefit from the scheme.

A possible modification of the layout that would give quite interesting working would be to concentrate on platforms 3, 4 and 5. If crossovers 4, 5 and 6 were retained, trains could arrive and depart from any of the platforms, the " fly-over " line being replaced by a standard acute-angle crossing joining line B by the right-hand points shown. The crossovers 4, 5, 6 would then be replaced by separate sets of points. These would effect the connections in the same manner, but would allow for the tracks being wider apart, as would be necessary owing to the use of the acute-angle crossing. Between the curved branches of corresponding points used in this manner two straight rails would be necessary, or two half curves with a quarter straight rail between them. The exact arrangement depends on the relative positions of the points in question. Of the two schemes, that employing the two straight rails is to be preferred, as it gives the trains an easier passage from one line to the other.

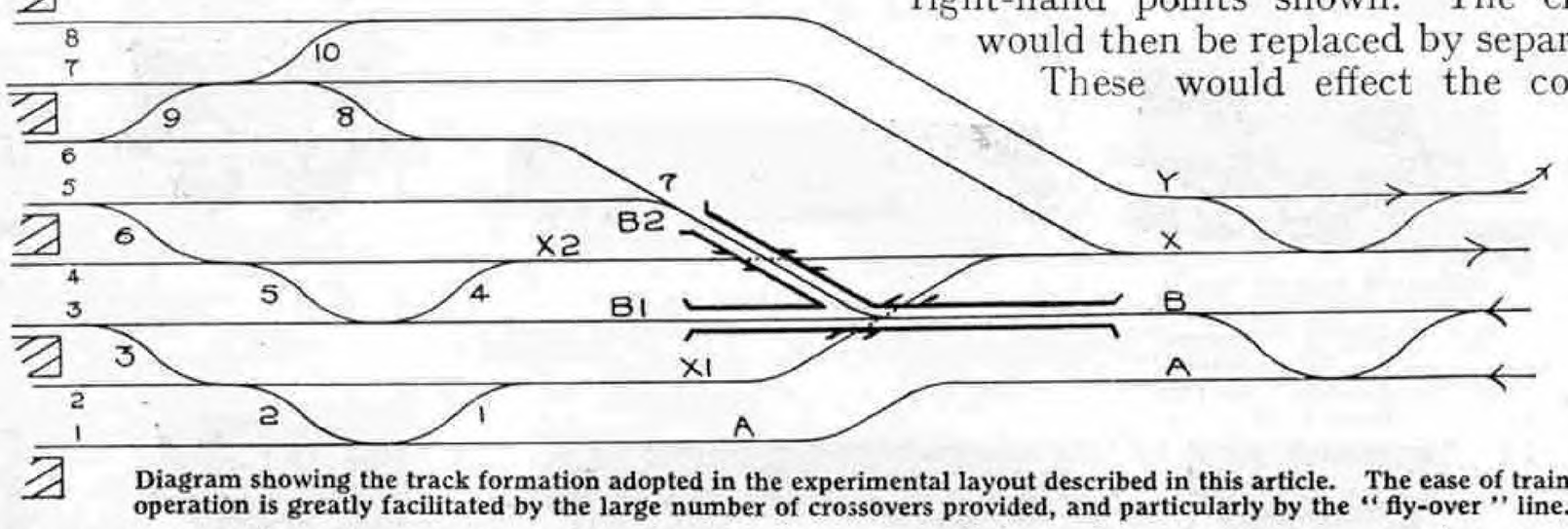


Diagram showing the track formation adopted in the experimental layout described in this article. The ease of train operation is greatly facilitated by the large number of crossovers provided, and particularly by the " fly-over " line.

HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE O

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines, strongly built and beautifully enamelled.

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Finished in yellow. Price **2/6**



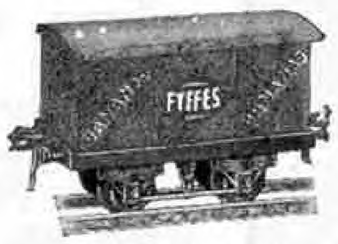
PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**



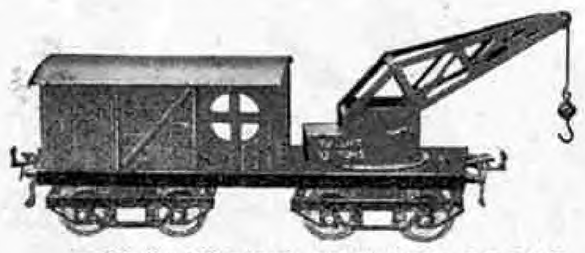
OIL TANK WAGON "CASTROL"
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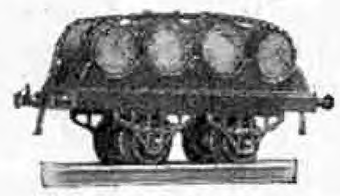
MILK TRAFFIC VAN No. 1
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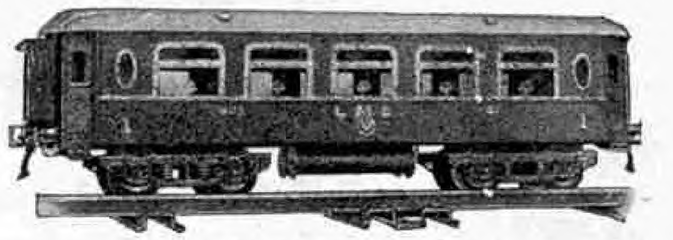
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Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**



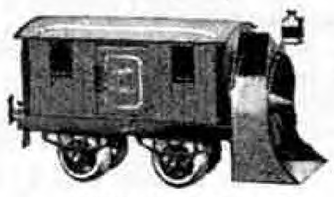
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/-**



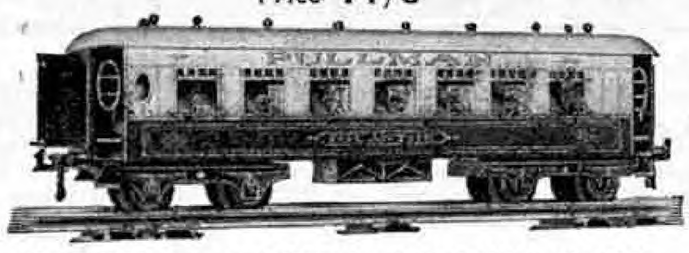
ROTARY TIPPING WAGON
Finished in orange. Price **3/-**



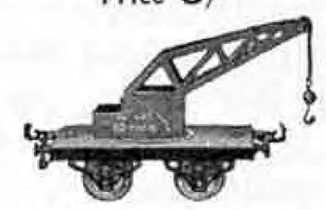
TIMBER WAGON No. 1
Beautifully enamelled in yellow and red. Price **1/9**



SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



HORNBY No. 2 SPECIAL PULLMAN COACH
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This new van is beautifully enamelled in blue with orange roof. Price **3/-**



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Finished in red. With opening doors. Price **3/-**

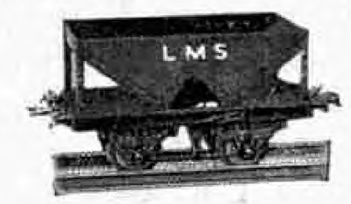


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Fitted with bolsters and stanchions for log transport. Price **2/-**



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Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

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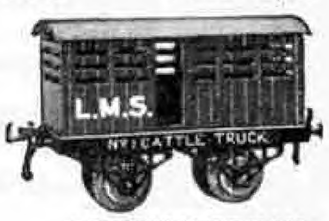
BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**



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Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**



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Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**



***CATTLE TRUCK No. 1**
Fitted with sliding doors. Very realistic design. Price **3/-**



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A very realistic model, finished in blue and white. Price **6/-**



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Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/-**

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FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **2/6**



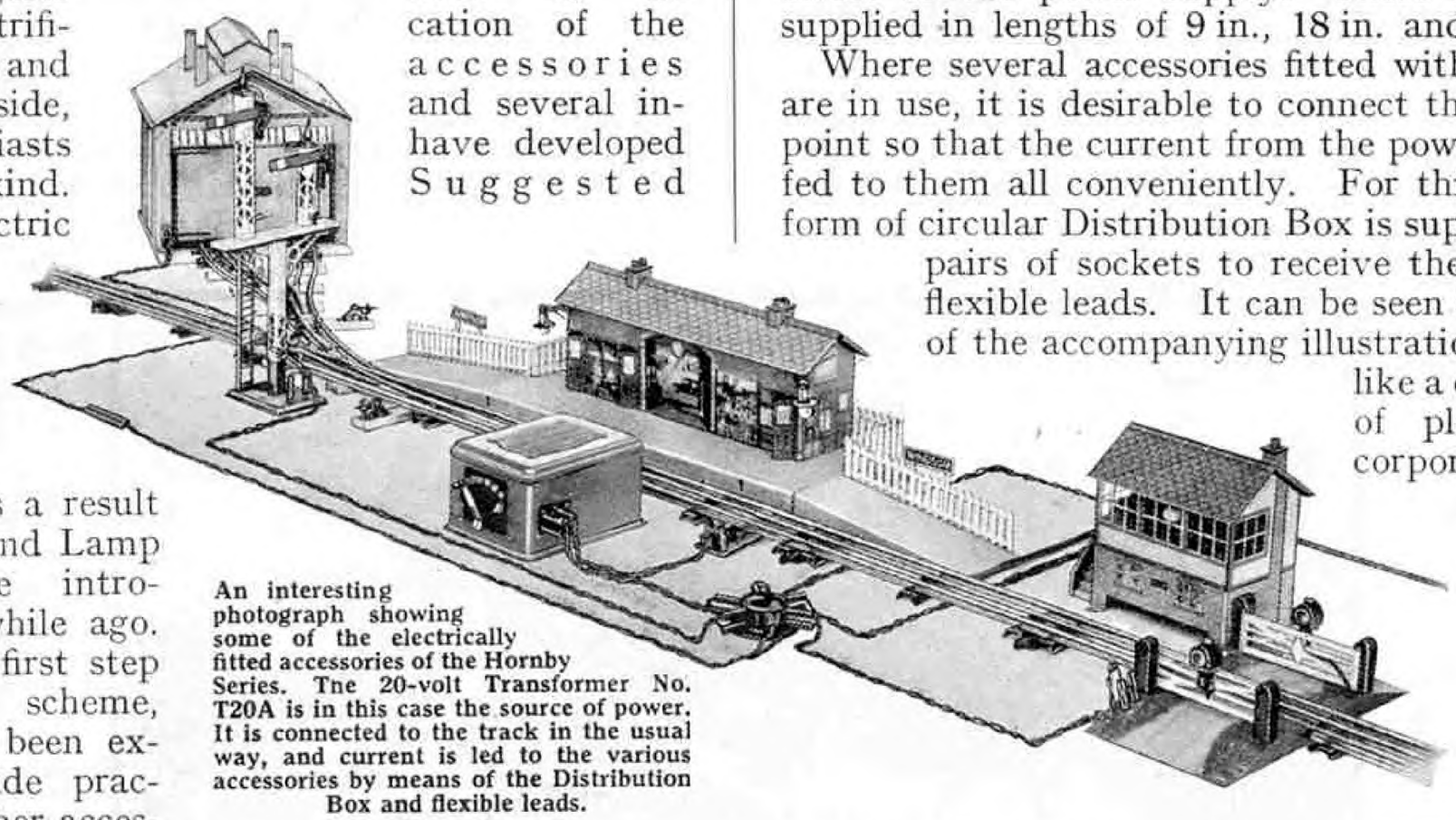
SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/-**

Manufactured by **MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13**

Electric Lighting for Hornby Layouts

By "Tommy Dodd"

IN spite of the extreme popularity of miniature locomotives propelled by clockwork, increasing numbers of Hornby Train owners are converting their layouts for electric traction. The Centre Rails, Clips and Insulators available for electrifying ordinary straight and curved rails are a great help in this, but it is necessary for the existing rails to have sleepers of the pattern standardised some time ago, with two central slots for the reception of the Clips. After an electric track has been completed and is in successful operation, the next step that suggests itself to its owner is the electrification of the various buildings and accessories and along the lineside, several ingenious enthusiasts have developed schemes of this kind. Suggested methods of electric illumination for station buildings and lamp standards have appeared in the "*M.M.*," and as a result of popular demand Lamp Standards were introduced a little while ago.



An interesting photograph showing some of the electrically fitted accessories of the Hornby Series. Tne 20-volt Transformer No. T20A is in this case the source of power. It is connected to the track in the usual way, and current is led to the various accessories by means of the Distribution Box and flexible leads.

This was the first step towards the scheme, which has now been extended to include practically all the other accessories of the Hornby Series where lighting is desirable. Full details of the various items will be found in the latest Hornby Train Catalogues, and in the 1932-33 "*Hornby Book of Trains*," and several of them are shown in the accompanying photograph.

The provision of lighting in the chief types of Signals in the Hornby Series has a special appeal, and the twinkling "red and green" effect seen in actual practice is now possible in miniature. This is shown to special advantage if the line is operated in the dark, the various strategic points being illuminated by Lamp Standards, or in the case of Engine Sheds, Stations, etc., by the lamps fitted in these particular accessories. The Signal Cabin, too—which may house the lever frame where the Control System is in use, or the Resistance Controller in some cases—is provided with a lamp inside, so that the control of signals, points, or the locomotive as the case may be, is rendered easy. Apart from utility, the illuminated Signal Cabin loo s particularly well from the outside.

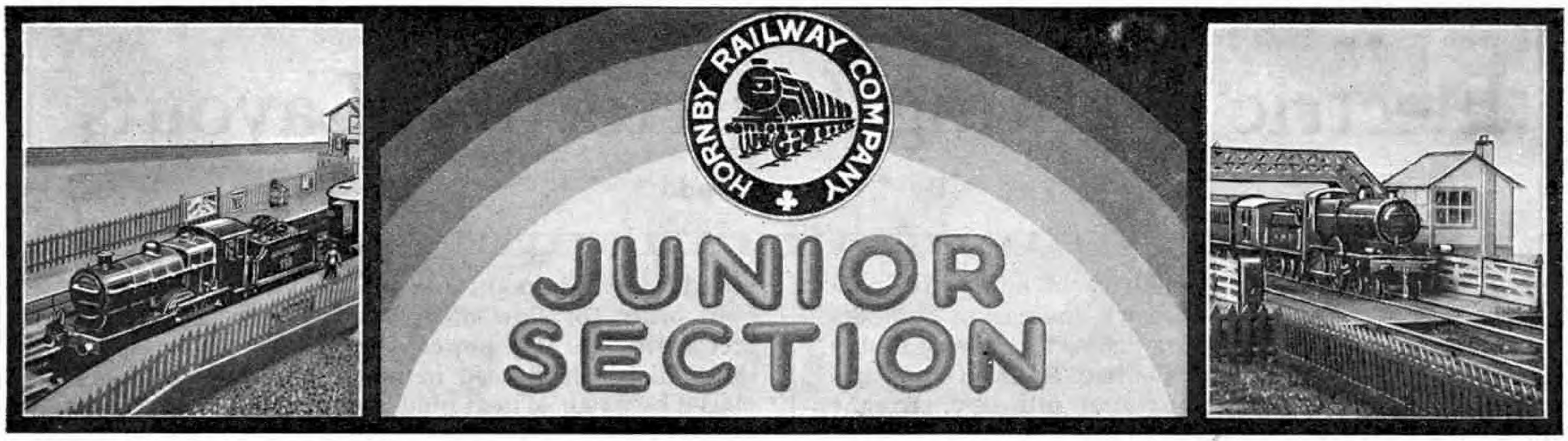
The handling of passenger trains at the Station or Island Platform, and the freight traffic dealt with at the Goods Platform, is made more convenient by the installation of lamps at suitable points. The provision of a lamp on the Water Tank as well is a great convenience when dealing with engines alongside it. In a small locomotive yard this lamp would no doubt be sufficient, thus eliminating the need for a Lamp Standard at this point and so economising current.

In order to allow of easy connection of the various accessories to the power supply, the ordinary screw terminals usually used in schemes of this kind are replaced by a pair of neat plug fittings that are conveniently located on each accessory. Standard lengths of special flex are available having twin plug fittings at one end and twin socket fittings at the other. The latter are placed on the plugs of an accessory, and the other end of the lead in the case of a simple installation is connected direct to the power supply. These flexible leads are supplied in lengths of 9 in., 18 in. and 36 in.

Where several accessories fitted with electric lighting are in use, it is desirable to connect them to a common point so that the current from the power supply may be fed to them all conveniently. For this purpose a neat form of circular Distribution Box is supplied, having five pairs of sockets to receive the plug ends of the flexible leads. It can be seen in the foreground of the accompanying illustration, looking rather like a capstan. One pair of plugs is also incorporated in it to fit the sockets of the lead from the power supply.

In the illustration it will be noticed that one of the new 20-volt Transformers No. T20A is shown. This is complete with regulator handle, so that the speed of the trains may be controlled. In addition it supplies current—not subject to the regulator—for lighting purposes at 17 volts; and there is a third circuit giving 20 volts, also not subject to the regulator. Where this Transformer is in use 20-volt bulbs must be used in the accessories that are to be illuminated. The accessories are supplied without bulbs so that these may be fitted by the purchaser according to the system in use for the power supply. The 20-volt bulbs cost 1/3 each. Postage is extra when they are ordered direct, and up to a dozen bulbs may be sent for 2d. When the train is running as many as eight of these bulbs may be lit up; but when the train is not running additional bulbs to a total of 13 may be used.

Those who already have electric layouts employing Hornby 6-volt locomotives may possibly think that the various electric accessories cannot be used on their systems. This is not the case, however, but the standard Transformer used for 6-volt trains is only intended for running one train at once, so that a separate power supply must be arranged for lighting purposes. If a Transformer is used for the purpose it must be remembered that the output of the standard No. T6 or No. T6A Transformer is actually 10 volts 2.5 amperes, so that special 10-volt bulbs will be required. These may be obtained at 1/– each, postage being as above. Up to ten of the bulbs may be lit from one Transformer.



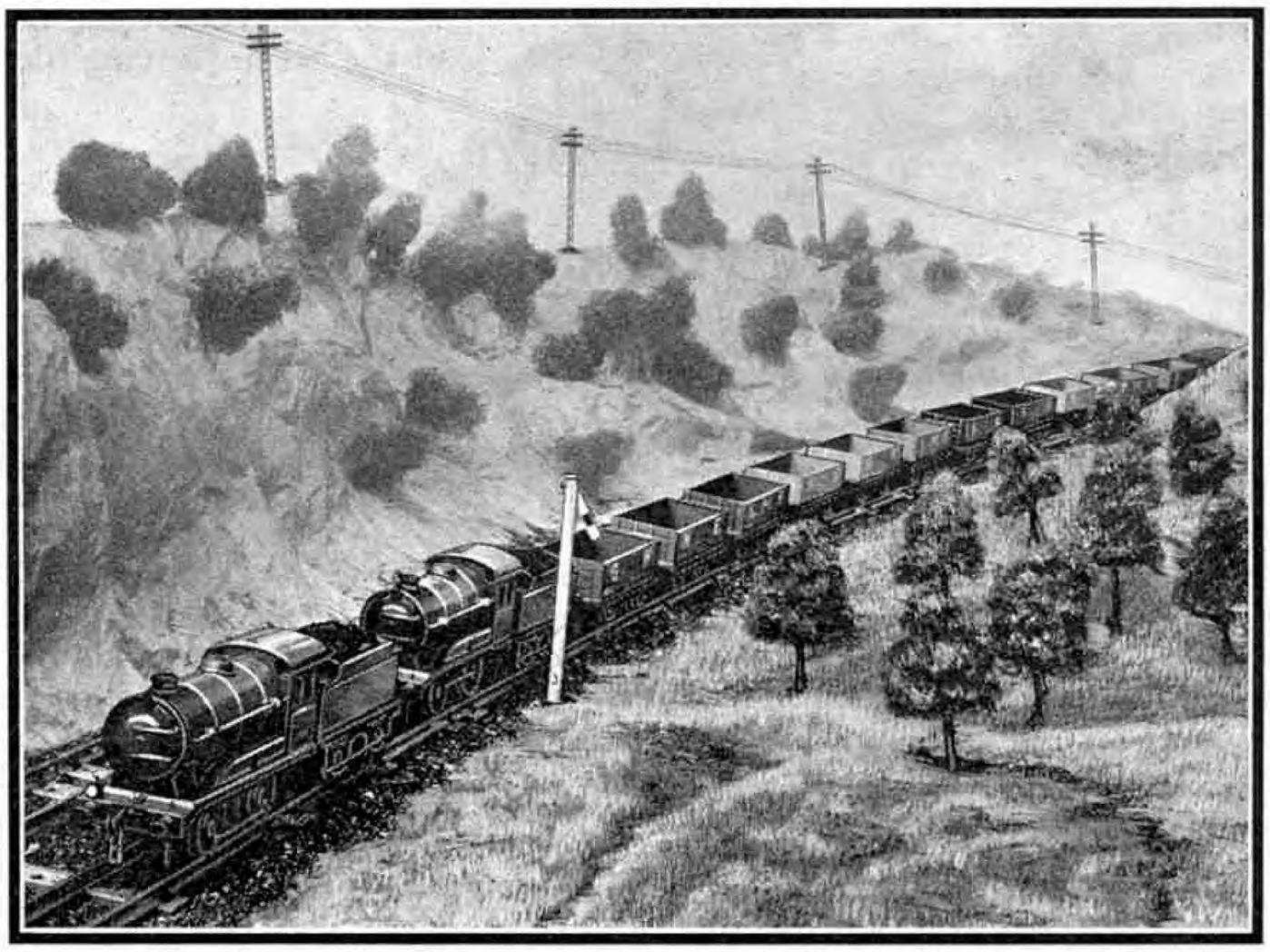
LII.—MISCELLANEOUS FREIGHTS FOR GOODS TRAINS

THE extraordinary variety of articles carried by our railways, both in the way of general goods and special items, is a particularly interesting subject to all who follow railway matters, and especially to those who possess miniature railways. On any model railway the appearance of loaded goods trains, busy goods platforms and yards is not only more true to life than the running of a collection of empty wagons along the track, but also the actual loading and despatch of different items from place to place is very attractive and gives a really business-like air to the proceedings.

The large selection of wagons in the Hornby Series is sufficient encouragement to take the question of freight traffic and its conveyance in miniature rather more seriously than is usually the case. It is easy to make up quite a number of trains each composed of different wagons, but this should not be the aim of the "Goods Department" of the miniature system. The traffic to be carried should be provided for by appropriate wagons as far as possible, but unlikely or unrealistic collections of wagons should be avoided.

The first load that suggests itself to most boys is probably coal or small stones. There is something particularly appropriate about coal, and it is interesting to remember that the necessity of providing for its carriage started our railway system. There is of course the objection that coal is dirty, and that the derailment or upsetting indoors of a miniature coal train, or even a single wagon, is likely to have unpleasant results! However, by the apparently strange but simple process of washing the coal it may be rendered quite dustless and clean to handle. The coal should be in small handy pieces and should be left to soak under water overnight. The water with the accompanying dust is then poured away, and the now clean lumps are dried by being spread out on an old newspaper. They are then quite fit to handle and may be loaded in the wagons as necessary before the train is assembled.

There is now a considerable variety of suitable wagons available in the Hornby Series. The smallest are the MO Wagons, then come the M1 kind. The No. O and No. 1 varieties are identical in size, but vary in the details of their finish. Then there is Open Wagon B fitted with a central tarpaulin bar, which may be swung out of the way as in actual practice if not required, as would be the case if coal or stone had to be conveyed. There is also the "Meccano" Coal Wagon of similar build, but without the tarpaulin bar. It is representative of the many thousands of wagons that run on our railways belonging to big industrial concerns, collieries and coal merchants, and known generally as private owners' wagons. With this selection it is not difficult to run very realistic coal trains as a regular practice.

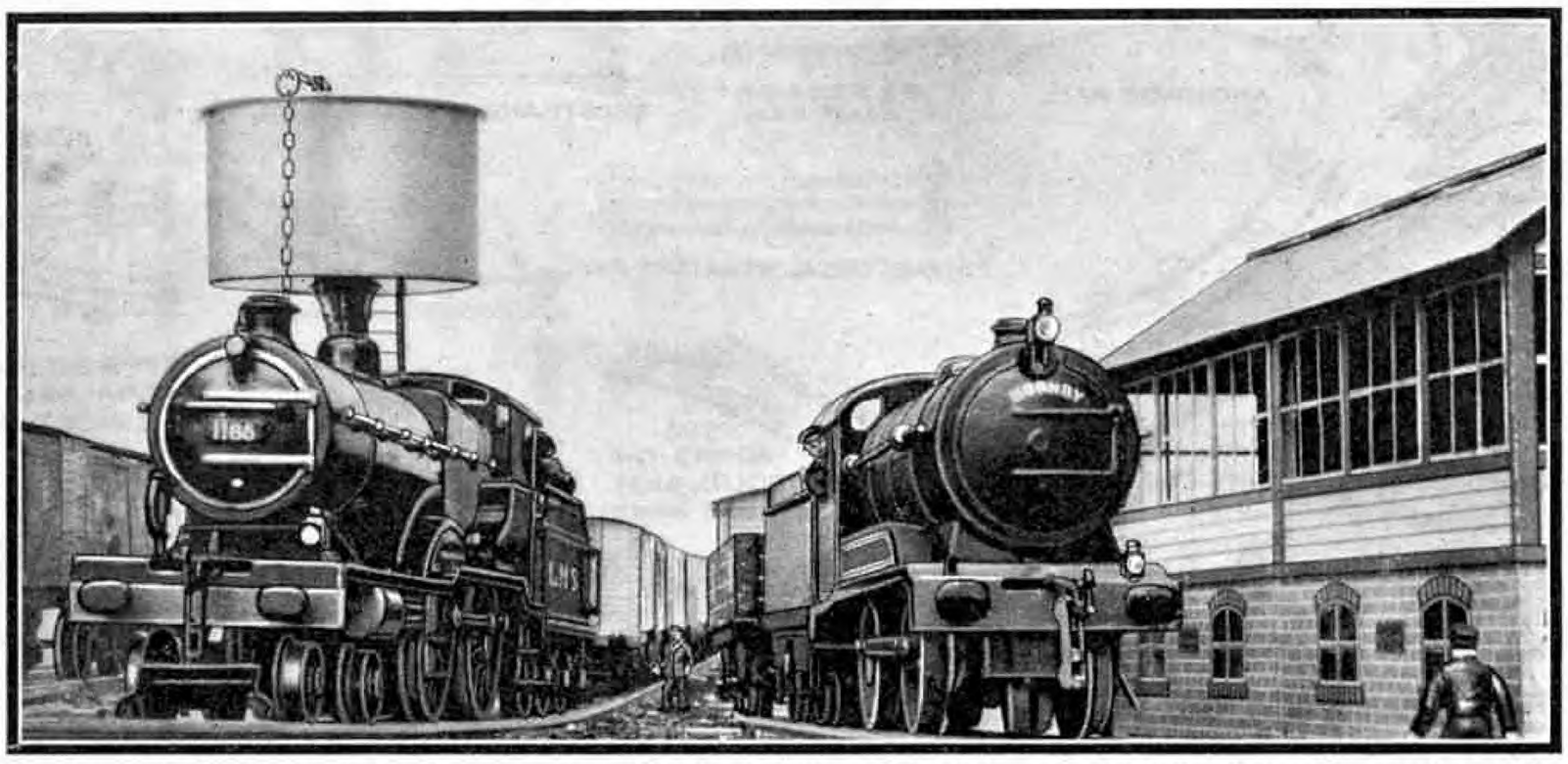


The haulage of empty wagon trains is a necessary feature of working that should not be neglected by Hornby Railway owners. A long train of "mineral empties" is shown in this photograph hauled by two Hornby No. O Locomotives, which make very suitable goods and mineral engines.

The weight of a long train thus loaded may be excessive, and in order to allow the locomotive a chance to give a good performance an alternative scheme suggests itself. Instead of filling up the wagons with more or less weighty substances, a cardboard shape is made up for each wagon like the lid of a box. It should fit easily into the wagon, and the height of its sides should be such that the actual "lid" portion is just below the top of the wagon body. This should be painted black, and when dry, glue or Seccotine should be spread over the top. Pieces of coal, washed as described above, should be set in it, and further layers should be built up by degrees so that a realistic heaped-up load is the result. This scheme may be applied to other substances as well, such as the small granite chippings that are often used for ballasting purposes on miniature railways. By means

of this scheme a variety of loads may be provided for a number of wagons, so that a complete coal train, stone ballast train, or a mixed train of variously loaded vehicles may be assembled.

Several items of Hornby rolling stock are supplied complete with appropriate loads, and the Coal Wagon already mentioned contains an embossed representation of coal. Then there are the Timber Wagons Nos. 1 and 2, each loaded with miniature lengths of sawn timber. The Lumber Wagons, with bolsters and stanchions, are well adapted for conveying a variety of lengthy loads in addition to the round poles with which the No. 2 pattern of these vehicles is supplied. These poles may represent a number of different items, according to requirements. An interesting suggestion is to wrap narrow strips of card round one end only of several of them, securing these with glue, and to paint the whole black, thus producing a reasonable representation of metal piping. Such loads may be conveyed more or less regularly for shipment abroad for use in oil pipe lines, or they may form purely local loads for more domestic purposes. Large diameter drain and water main pipes may be easily made by adapting suitable circular gas mantle containers or lengths of postal tubes, one end being fitted with a single or double thickness of card to imitate the socket portion of such pipes.



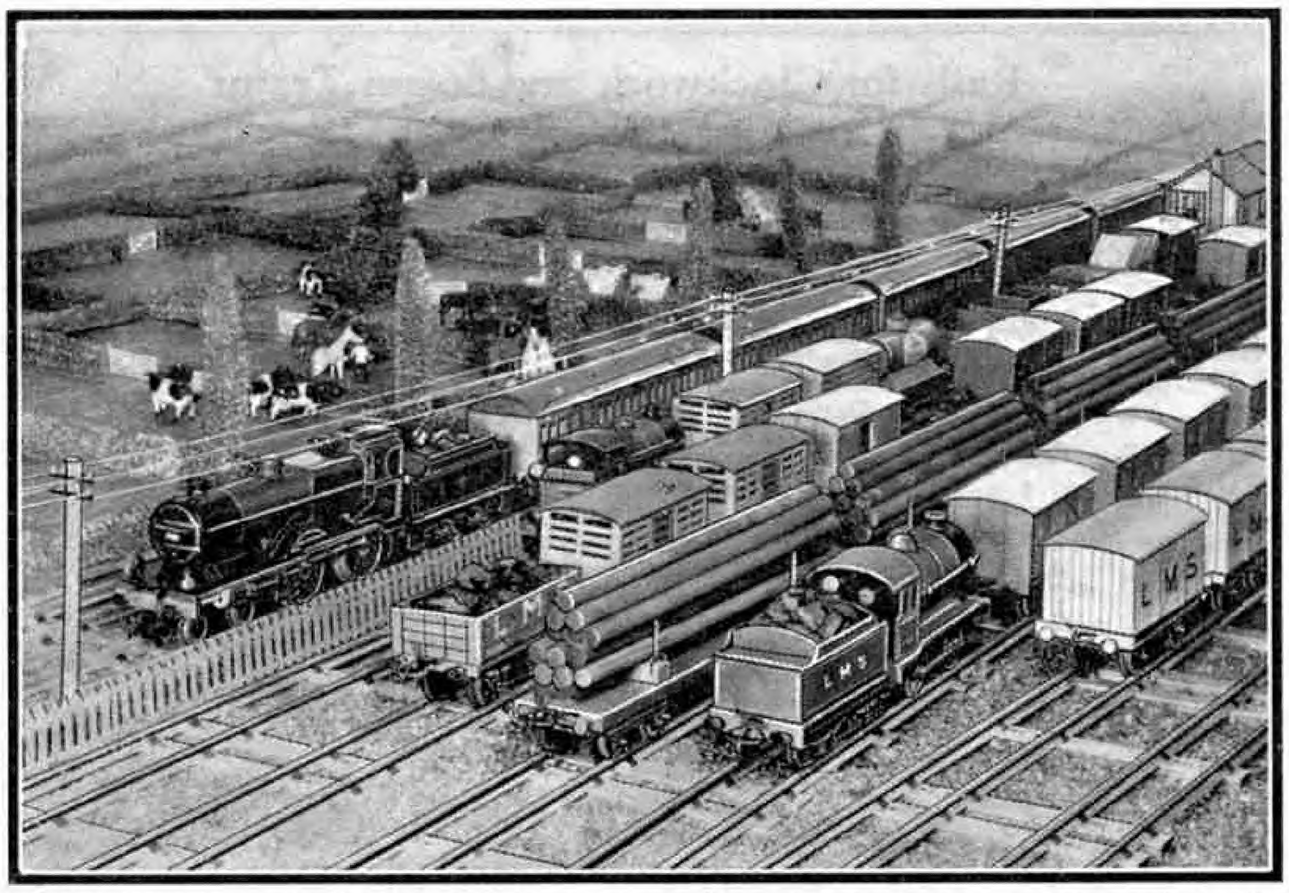
Express goods trains are regularly run on many Hornby layouts. This photograph shows two locomotives ready to take charge of such trains and both of them are displaying the appropriate headlamp code.

The barrels provided on the Barrel Wagon are useful, and in addition to their conveyance in numbers on their own special wagon, odd ones look well mixed up with other articles of miscellaneous freight, either on the Goods Platform or loaded in a suitable wagon.

As regards heavy or bulky items of a special nature, little need be said. The Trolley Wagon is particularly well adapted for their conveyance, as it is of the well pattern commonly used in actual practice. Many suitable loads may be made up from Meccano parts, either girders, machinery or engines for stationary plants, of light or heavy nature as required. These are favourite forms of loads with miniature railway owners, and have frequently been mentioned in these pages in addition to references to actual practice.

We now have to consider the great variety of freight that is necessarily handled in vans or covered wagons. One of the latest introductions into the Hornby Series, Modelled Miniatures Set No. 2, consisting of miniature animals, is particularly useful, for the various domestic animals contained in it are not only suitable for use along the lineside, but may also form loads for the Cattle Wagons of the Hornby Series. Markets, shows and sales may be supposed reasons for the transport of the animals, and special passenger facilities should be provided in connection with them in addition. For the easy loading of the animals a cattle pen is desirable, and those interested may refer to the *"M.M."* of last August, where a pen formed of standard components was described.

In addition to the regular carriage of such domestic livestock, there are times when railways are called upon to transport more unusual and occasionally less tame animals. In the event of a complete menagerie travelling a long distance, or possibly a consignment of beasts for a public zoo arriving from abroad, special care has to be taken in arranging for their conveyance. From our correspondence it appears that many of our younger readers possess miniature jungle animals and frequently arrange them as a local attraction at some suitable spot along the lineside. Special interest will be given to a railway by the occasional arrival by train of additional members of such a miniature Whipsnade, and no doubt the rolling stock department will have to exercise their ingenuity to provide suitable vehicles for one or two more or less cumbersome elephants.



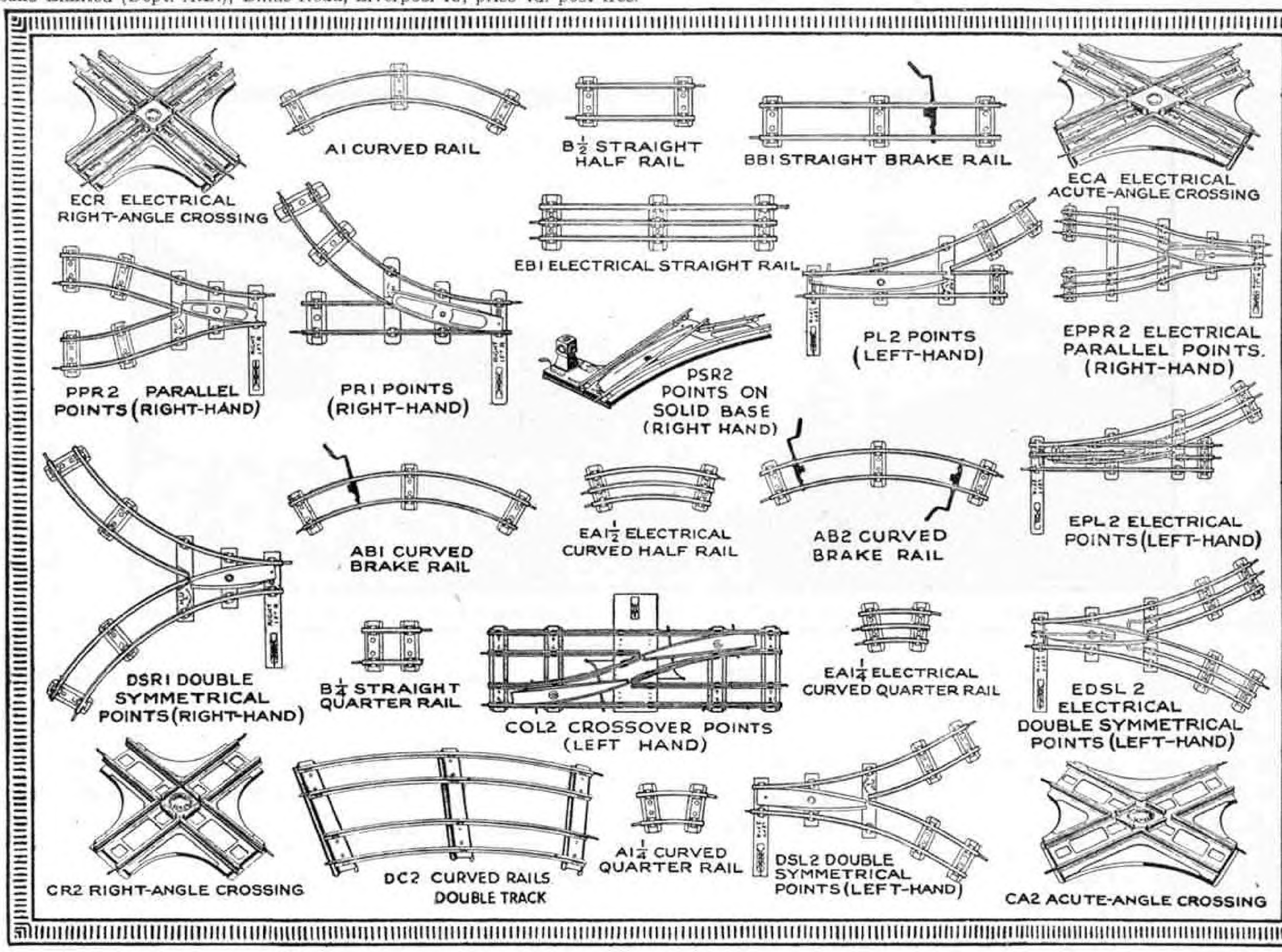
A busy scene in a miniature marshalling yard. Various wagons are shown in the sidings with suitable loads, while an express passenger train is passing on the main line.

Of loads already provided, the Milk Cans in the Milk Van No. 1 should not be forgotten. Although milk tank wagons are now largely used—and of course the very fine example of a miniature United Dairies Milk Tank Wagon is well known to our readers—the familiar can or churn does not appear likely to disappear for some time. The Hornby Milk Cans are also available in Set No. 2 of Railway Accessories. They

(Continued on page 285)

Hornby Series -:- Rails, Points and Crossings -:- Hornby Series

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. The variety of Points, left-hand and right-hand turnout, together with the Crossings, make possible an almost endless number of realistic and railway-like layouts. The adaptability of the Rails, Points and Crossings is well shown in a special booklet "How to Plan your Hornby Railway," which is obtainable from your dealer, price 3d., or from Meccano Limited (Dept. A.B.), Binns Road, Liverpool 13, price 4d. post free.



Alternate Pegs

CURVED RAILS

9-in. radius (For MO Trains)

M9	Curved rails	doz.	3/-
MB9	Curved brake rails	each	3½d.

1-ft. radius

A1	Curved rails	per doz.	4/6
A½	Curved half rails	„	3/6
A¼	Curved quarter rails	„	3/-
AB1	Curved brake rails	each	6d.

2-ft. radius

A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/-
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

STRAIGHT RAILS

BM	Straight rails (for MO Trains)	per doz.	2/9
B1	Straight rails	„	4/-
B½	Straight half rails	„	3/-
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.

Rails for Clockwork and Steam Trains

BBR1	Straight brake and reverse rails	each	1/6
DS1	Straight rails, double track ...	½ doz.	6/6

DOUBLE SYMMETRICAL POINTS

For 1-ft. radius curves

DSR1	Double symmetrical points, right-hand	per pair	5/-
DSL1	Double symmetrical points, left-hand		

For 2-ft. radius curves

DSR2	Double symmetrical points, right-hand	per pair	5/-
DSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

PPR2	Parallel points, right-hand	per pair	5/-
PPL2	Parallel points, left-hand		

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/-
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9

Gauge 0, 1¼"

CR1	Right-angle crossings (for 1-ft. radius tracks)	each	2/-
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9

CROSSOVER POINTS

COR2	Crossover points, right-hand	per pair	12/-
COL2	Crossover points, left-hand		

POINTS

9-in. radius (For MO Trains)

MR9	Right-hand points	per pair	3/-
ML9	Left-hand points		

1-ft. radius

PR1	Right-hand points	per pair	4/-
PL1	Left-hand points		

2-ft. radius

PR2	Right-hand points	per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		
RCP	Rail connecting plates ...	½ doz.	2d.

Rails for Electric Trains

CURVED RAILS

1-ft. radius

EA1	Curved rails	per doz.	6/6
EA½	Curved half rails	„	4/6
EA¼	Curved quarter rails	„	4/-

2-ft. radius

EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/-
EDC2	Curved rails, double track ...	½ doz.	9/-

STRAIGHT RAILS

EB1	Straight rails	per doz.	6/-
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/-
EDS1	Straight rails, double track ...	½ doz.	8/6

CROSSINGS

ECA	Acute-angle crossings ...	each	4/-
ECR	Right-angle crossings	„	4/-

POINTS

For 2-ft. radius curves

EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		

DOUBLE SYMMETRICAL POINTS

For 2-ft. radius curves

EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

For 2-ft. radius curves

EPPR2	Parallel points, right-hand...	per pair	8/6
EPPL2	Parallel points, left-hand ...		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/-
ECOL2	Crossover points, left-hand		
TCPL	Terminal connecting plates (low voltage)	each	1/6

Electrical Points for 1-ft. radius curves are not supplied.

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. radius

AC1	Curved centre rails ...	... per doz.	1/-
AC½	Curved centre half rails ...	„	9d.
AC¼	Curved centre quarter rails ...	„	6d.

2-ft. radius

AC2	Curved centre rails ...	... per doz.	1/-
AC2½	Curved centre half rails ...	„	9d.
AC2¼	Curved centre quarter rails ...	„	6d.

STRAIGHT CENTRE RAILS

BC1	Straight centre rails ...	... per doz.	1/-
BC½	Straight centre half rails	... per doz.	9d.
BC¼	Straight centre quarter rails ...	„	6d.
ICR	Insulators for insulating centre rails	... per doz.	3d.
CCR	Clips for fixing centre rails ...	„	6d.

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL 13

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Liverpool 13. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

ANOTHER "HIDDEN STATIONS" CONTEST

Keen interest is maintained by H.R.C. members in the railway problems set before them month by month. The entries submitted in these contests, so far from diminishing in numbers, are steadily increasing. Our records show that particularly popular contests are those where members have to exercise both their ingenuity and their general railway knowledge in solving word-building or word-finding problems. This month we announce another contest of this type.

In the panel in the centre of this page are 20 words made up of an apparently wild assortment of letters. Each of these queer-looking words, when the letters are arranged in the correct order, is the name of a British railway station, and we set H.R.C. members the pleasant task of identifying the names of these stations. There is no catch in any of the words; in spite of appearances, each will be found to be the name of a station on one of the four group companies' systems. Some of the stations are on main lines, others are less well known; but all are to be found without difficulty in "Bradshaw" or other railway timetables.

When competitors have discovered all the correct stations, or as many of them as they can find, they must make a list of them in the order in which they appear in the panel. Alongside each station must be written the initials of the railway company on whose lines it lies.

1.	Aoggr	11.	Disenls
2.	Ubaron	12.	Lebydasiar
3.	Ftigofnnu	13.	Ghrilitgndno
4.	Lerlor	14.	Lstuc
5.	Talys	15.	Boots
6.	Nevrodoc	16.	Arywe
7.	Losem	17.	Adurmhsrledon
8.	Schoskas	18.	Easrravnc
9.	Nabercludum	19.	Loryyodthmm
10.	Dofredf	20.	Suklkanc

Prizes consisting of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the entries containing the largest number of correct solutions. In the case of a tie for any prize, preference will be given to the entry that is neatest or presented in the most novel or ingenious manner. In addition to the main prizes a number of consolation prizes will be awarded to the entries which, while below prizewinning standard, are at the same time praiseworthy efforts to tackle the contest.

Envelopes containing entries must be clearly marked H.R.C. "Hidden Stations Contest" in the top left-hand corner, and posted to reach headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 29th April. The closing date for the Overseas Section is 31st July. Entries received after these dates cannot be entertained.

Every entry submitted for this contest must be clearly marked with the sender's name and full address and H.R.C. membership number. Failure to observe this condition will result in disqualification. This is an important feature to which members should pay special attention, as its neglect in the past has occasionally caused promising entries to be discarded.

Railway Photographic Contest

The coming of Easter may be said to mark the opening of the popular photographic season. With this first public holiday of the year thousands of cameras that have been practically forgotten throughout the winter are remembered and hauled from their hiding places, and prepared for action. H.R.C. members will naturally turn their thoughts towards the securing of a series of good railway photographs. Railway photography is a splendid hobby, and in order to encourage it we offer this month prizes for the best photographs of "*Any Railway Subject.*" Thus members are free to exercise their preference for any particular aspect of railway working.

Competitors may submit as many prints as they desire, but no competitor can win more than one prize. It is important that every print sent in should have on the back the name, address and H.R.C. membership number of the sender. Omission of this number will result in disqualification.

The contest will be divided, as usual, into two sections, Home and Overseas; and prizes of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the best photographs submitted in each section.

Envelopes containing prints should be clearly marked "H.R.C. Railway Photo Contest," and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 29th April. Overseas closing date, 31st July.

Drawing Contest

Drawing Contests with objects of railway interest as their subject always produce a good crop of entries. In past contests of this nature we have invited H.R.C. members to test their skill in contests calling for drawings of steam or electric locomotives, or of trains at speed. This month we have chosen as the subject of this Drawing Contest "*A Signal Cabin.*"

The competition is not restricted to any particular kind of signal cabin, and competitors may draw either a large main line cabin or a small wayside box as seen at a small countryside station. If desired, the drawing can be coloured.

The competition will be divided into the usual two Sections—Home and Overseas. To the competitors who submit the four best entries in each of the two sections will be awarded prizes of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition a number of consolation prizes will be awarded to those competitors whose entries do not quite come up to prizewinning standard.

Envelopes containing entries should be clearly marked "*H.R.C. Signal Cabin Drawing Contest*" in the top left hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 29th April. The closing date for the Overseas Section is 31st July. Members' H.R.C. numbers must be quoted. The closing dates should be carefully noted as entries received late cannot be passed on to the judges.

COMPETITION RESULTS

HOME

January "New Year Signalling Contest."—First: D. E. Fozard (32460), Goole. Second: E. G. Gutbush (10353), Belvedere, Kent. Third: J. F. Grindley (2067), Whittington, Nr. Oswestry. Fourth: C. E. Wrayford (6039), Moretonhampstead, Devon. Consolation Prizes: S. Cross, (4849), Birmingham; A. Little (29474), Cleland, Lanarks.; H. Pope (7380), London, S.E.7; A. Bruce (3937), Cleadon, Nr. Sunderland; D. T. Howsley (24784), Matlock, Derbys.; R. Eyles (10010), Wolverhampton; G. A. Hogg (9319), Edinburgh.

January "Railway Joke Contest."—First: W. P. Wiseman (24776), Great Yarmouth. Second: F. C. Hirst, Shipley, Yorks. Third: R. M. Arnold (31111), Bangor, Co. Down. Fourth: E. K. Hattersley (20761), Manchester. Consolation Prizes: G. Smith, Hanwell, London, W.7; A. McDonald (30743), Edinburgh; J. T. Aldren (3226), Birmingham; D. M. Young (23014), Birmingham; A. Exley (26480), Chester-le-Street, Co. Durham.

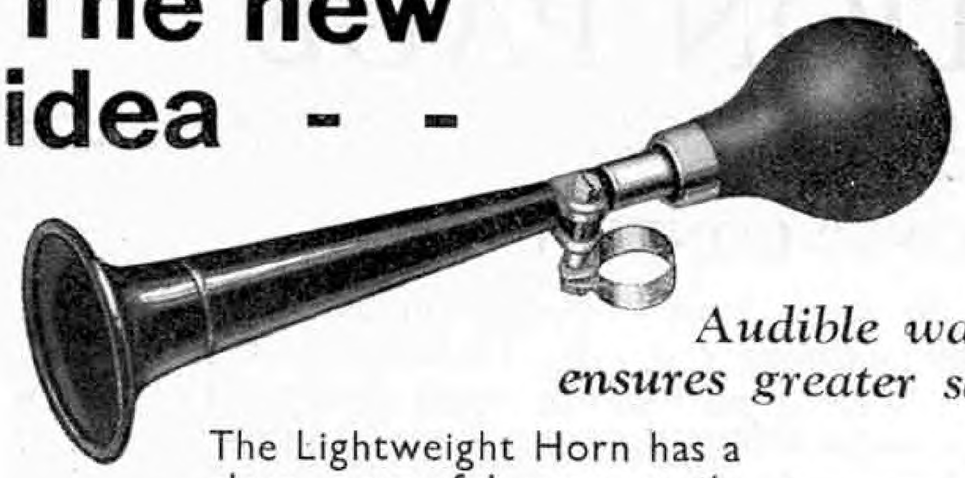
January "Voting Contest."—First: R. C. Storrar (8625), Letham Ladybank, Fifeshire. Second: T. W. Chatfield (9197), West Worthing. Third: D. Fell (2068), Disley, Nr. Stockport. Fourth: A. P. Derham (3352), Bristol. Consolation Prizes: G. E. Waters (20630), Southall, Middx.; K. Wager (27343), Halfway, Skeerness; E. Bruton (10316), London, S.W.9; C. G. Tildsley (17624), Hanley, Staffs.; D. Brooks (25150), Alveston, Nr. Bristol; T. Bennett (21596), Dunphail; L. Parish (18054), Coventry; W. R. J. Matheson (24597), Inverness.

OVERSEAS

October "H.R.C. Errors Contest No. 3."—First: A. N. Starling (22602), Natal, South Africa. Second: F. Eagle (28845), Bombay, India. Third: J. H. Neville (23636), Darlington, W. Australia. Fourth: W. B. Moore (20918), Toronto, Canada. Consolation Prizes: P. Chapman (24873), Christchurch, New Zealand; M. Balfe (28661), Vancouver, Canada; D. McLeod (29024), Natal, South Africa; W. T. Munro (22754), Auckland, New Zealand; M. Orde (8865), Switzerland; J. Stanbridge (10236), Perth, W. Australia; J. Hers (8270), Johannesburg, S. Africa; A. C. Davies (23627), Victoria, Australia.

October "Layout Planning Contest."—First: R. Hondelink (25394), Holland. Second: R. S. Robbins (29906), Victoria, B.C., Canada. Third: P. D. Charlwood (30116), Sydney, N.S.W., Australia.

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The Lightweight Horn has a clear, powerful note, easily heard above the roar of traffic, at cross-roads, etc. Made in polished celluloid, the body cannot dent, rust nor chip.

Illustrated leaflet and list of the famous "Noweight" Celluloid Mudguards, Inflators, etc., post free on request.

The new No. 1 "Noweight" Celluloid Cycle Horn **3/6** each Black or White

Coupon for your convenience.

Bluemels

POST NOW

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To Bluemel Bros. Ltd., Wolston, nr. Coventry

Please send illustrated list, post free.

"Meccano"

Name .....

Address .....

WRITE CLEARLY IN BLOCK LETTERS AS THIS

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No licence is necessary to purchase or to use in the house or garden.

If you haven't a B.S.A. Air Rifle you are missing one of the finest sports you can enjoy—shooting.

At this time of the year there are a variety of pests and vermin which you can shoot with a B.S.A. Air Rifle; jays, magpies, rooks, rats, rabbits, etc. And it is great fun testing your skill as a shot against these destructive pests.

B.S.A. Air Rifles shoot B.S.A. Lead Pellets which cost only **2/3** a 1,000 (.177" size)—37 accurate shots for one penny. And they are certain killers up to 30 yards. But get the B.S.A. Rifle Catalogue by posting the coupon.

Price 45/- or 4/3 a month

Post the coupon TO-DAY!

B.S.A. Guns Ltd., 92, Armoury Road, Birmingham, 11.

Please send B.S.A. Air Rifle Leaflet.

Name .....

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Sir Malcolm Campbell's Triumph

272 MILES AN HOUR! *in his Rolls-Royce engined "Blue Bird"*

a different engine... new streamlining... but ALWAYS ETHYL

Pratts WITH ETHYL

ETHYL GASOLINE CORPORATION

SPECIAL

Ever since Pratts Ethyl special has been available, Sir Malcolm Campbell has always used it in his famous "Blue Bird." Now he has put up his own world's speed record of 253.8 to 272.108 m.p.h. The red Ethyl fluid used in blending this fuel was *identically the same* as that used in blending Pratts Ethyl Petrol as sold to the public through roadside pumps everywhere at the same price as ordinary petrols.

There's Good Health in—

KIA-ORA

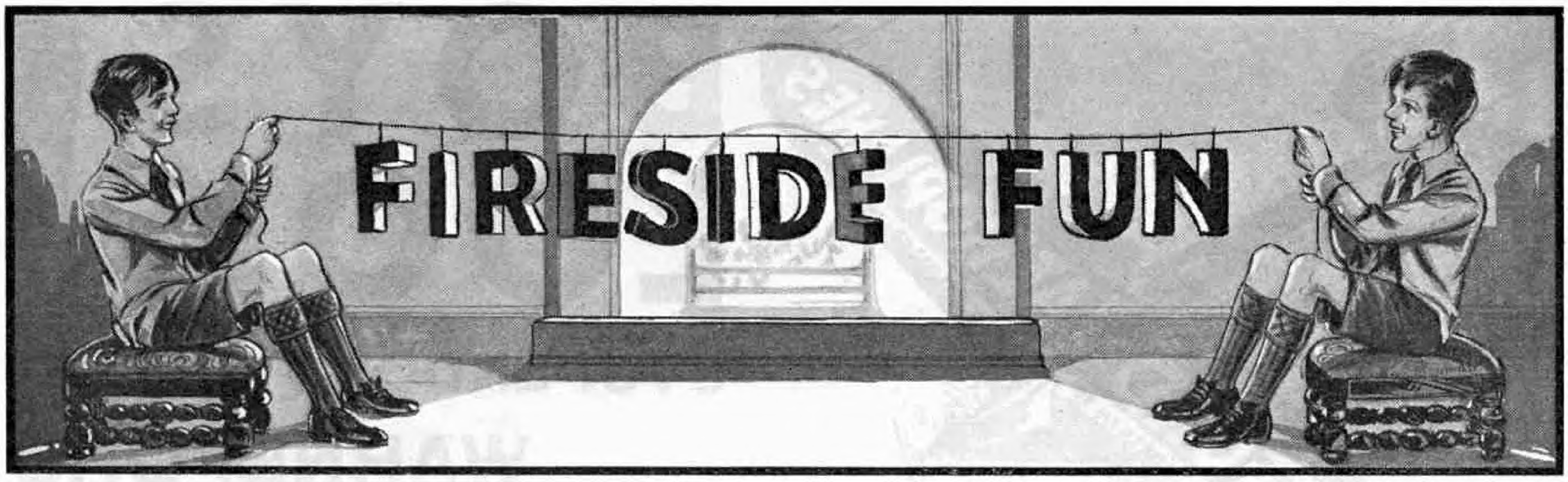
LEMON ORANGE GRAPE FRUIT

Kia-Ora is the most healthful and delicious of all fruit drinks because it is the juice of the finest ripe fruit only, sufficiently sweetened with cane sugar. . . . Grape Fruit, Lemons and Oranges in their most convenient form, retaining to the full all the essential vitamins of the fresh fruit itself.

You will find Grape Fruit Squash excellent before breakfast—but all three are ideal drinks for any time and occasion. Ready for use by mixing with five parts plain or soda water.

Prices: Per large bottle, 2/-
Per full ½ bottle, 1/1

KIA-ORA LIMITED
Blackfriars, London, S.E.1



A LONG DAY

Two old darkies were discussing a mutual friend.

"Dat man sure is a worker," said Sambo. "He works 25 hours a day."

"How come? Dere's only 24 hours in ebbery day."

"Yes, my friend; but dat man gets up early and works an hour before daylight."

* * * *

"If it wasn't for me," said Bob proudly, "my class wouldn't have any standing at all."

"But I thought you were always at the foot of the class," said his mother.

"So I am," admitted Bob, "and how could it stand if it didn't have a foot?"

* * * *

One afternoon a somewhat vain organist had been "showing off." As he was leaving the church he remarked to the blower, hoping to secure a compliment: "Well, Jock, I hope you have not been too bored with my playing to-day?"

"It's all right, sir," was the reply. "I gets lots of people come and make queer noises on my organ. Some of 'em are worse than you."

* * * *

Passenger: "Hey, porter, how long will the next train be?"

Porter: "About seven coaches, sir."

Passenger: "Smart, aren't you?"

Porter: "No, I'm Jenkins. Smart has gone home to dinner."

* * * *

Little Boy: "Please will you take my sister home? She's lost."

Constable: "Why don't you take her home?"

Little Boy: "I'm lost as well."

* * * *

A cheap-jack was trying to get his audience into a good humour before offering his goods. Producing a shilling, he said:

"Now, ladies and gentlemen, here is a chance for you. A real silver shilling; how much will you give me for it?"

Bids came quickly, until a boy piped out: "Elevenpence."

"Very well, it's yours, my boy. Where's the ele enpence?"

"Take it out of the shilling and give me the change," said the successful bidder.

* * * *

GREAT SHAKES!



"I'm ill, I'm trembling like a leaf!"

"Then get hold of the sieve!"

* * * *

"Do you still quarrel with your neighbour about his dog invading your garden?"

"No, that's all over now."

"Buried the hatchet?"

"No, the dog."

* * * *

Visitor to factory: "Why does the whistle blow for a fire?"

Guide (fed up): "It doesn't blow for the fire, it blows for water. They've got the fire."

NOT A PAPER HAMMERER

Mrs. Fussy was having an upstairs room decorated. Thinking to catch the workman wasting his time she crept to the bottom of the stairs and suddenly shouted out:

"Painter, are you working?"

"Yes, ma'am," came the reply.

"I can't hear you making a sound," she returned.

"Perhaps not, ma'am," he shouted back. "I ain't puttin' the stuff on with an 'ammer."

* * * *

A MISUNDERSTANDING



"Madam, if you buy this car we will put your initials on free!"

"But my husband says it's not the initial cost that matters, but the upkeep!"

* * * *

Teacher (to small boy): "Now you have in front of you the north; on your right the east, and on your left the west. What have you behind you?"

Small Boy: "A patch. I told mother you'd see it!"

* * * *

A town's meeting had been called to discuss a matter of great local interest. The Mayor, who was in the chair, rose to make a few remarks.

"Ladies and Gentlemen," he began, "it gives me great pleasure to see such a dense crowd here to-night."

"'Old 'ard, guv'nor," protested one of the crowd, "we ain't all dense."

* * * *

Judge: "Now, how big was this stone that you say the prisoner threw through the shop window? Was it as big as my fist?"

Witness: "Oh, much bigger, my lord."

Judge: "Was it as big as my two fists?"

Witness: "Bigger still, my lord."

Judge: "Was it as big as my head?"

Witness: "Well, it was about as long, my lord, but not quite so thick."

* * * *

"What did the landlady do when she found that you had left the light burning for three days?"

"She turned us both out."

* * * *

Mother: "Robert, you haven't studied your history lesson."

Bobby: "Aw, mother, why not let bygones be bygones?"

* * * *

Passenger: "Why don't they have this station near to the town?"

Porter: "Dunno, sir, but perhaps it's because they want it near the railway."

* * * *

Salesman: "Ladies and Gentlemen, I have here the famous flexible comb that will stand any kind of treatment. You can bend it double, you can hit it with a hammer, you can twist it, you can—"

Interested Listener: "Say, mister, can you comb your hair with it?"

PIECE WORK

"Here is an apple, Willie. Divide it generously with your sister."

"How shall I divide it generously, mother?"

"Why, always give the larger part to the other person, my child."

Willie reflected for a moment, then he handed the apple to his little sister. "Here, Ethel, you divide it!" he said.

* * * *

A barrister, pleading on behalf of a child of four years, brought it before the Court, and in his peroration took it in his arms. The child wept, and its tears, along with the barrister's eloquence, moved the jury.

The opposing barrister, disturbed to see the emotion, said to the child: "My dear, why are you crying?"

"He's pinching me," sobbed the little one.

* * * *

There was great excitement aboard the liner.

"Man overboard!" was the cry.

"Gentleman overboard, if you please," said Mrs. De Snobbe, indignantly. "That's my husband."

* * * *

Landlady: "And what's wrong now?"

Youthful Lodger: "I just wanted to say that I think you get too much mileage out of this roller towel."

* * * *

A lady of commanding appearance returned to her seat in a train and found it occupied by a small man reading a paper. "Sir, I'm sitting there!" she said.

The man looked up placidly. "Madam, pray remain seated," he replied.

* * * *

As the train drew into the station the traveller rushed up to the driver. "Congratulations," he said. "I've travelled on this line for thirty years and it's the first time I've known you to arrive on time. Have a cigar!"

"Keep your cigar," said the driver; "this is yesterday's train."

* * * *

School Inspector: "Would any of you boys like to ask me a question?"

Pupil (fed up): "Please sir, what time does your train go?"

* * * *

PERPETUAL MOTION



"What are you running for?"

"I'm trying to catch my breath."

* * * *

Builder's Foreman: "Excuse me, ma'am, but are you the lady as was singing?"

Lady Vocalist: "I was singing, yes."

Builder's Foreman: "Well, would you kindly not 'old that top note so long! My men 'ave knocked off work twice, thinking it was the dinner whistle."



BOYS LOOK!

STUPENDOUS VALUE!

WARNEFORD FLYING AIRCRAFT

WITH

Unsurpassed Performances

FOURTEEN FINE AEROPLANES TO SELECT FROM

PRICES FROM 1/6 to 5 Gns.

EXAMPLES

THE "NIPPER" 2/6 Flies 550 ft.

THE "IMP" 6/- Flies 800 ft.

THE "SWIFT" 10/6 Flies 1,250 ft.

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You Must Go to

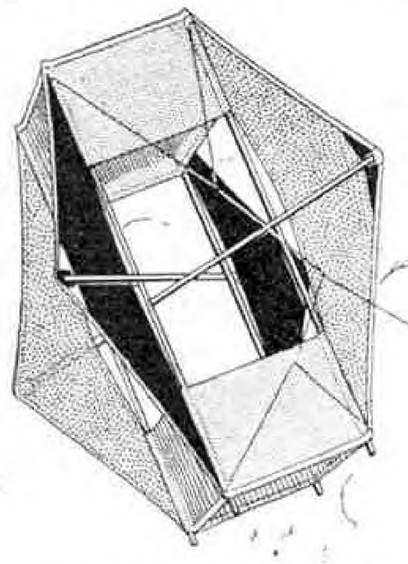
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During the Easter Holidays

See all the latest developments in Model Aeroplanes, Kites, Yachts, Boats, etc. There will be a splendid display of Cricket kit for the new season, Conjuring demonstrations and a host of other attractions for boys of all ages.

HORNBY TRAINS AND MECCANO

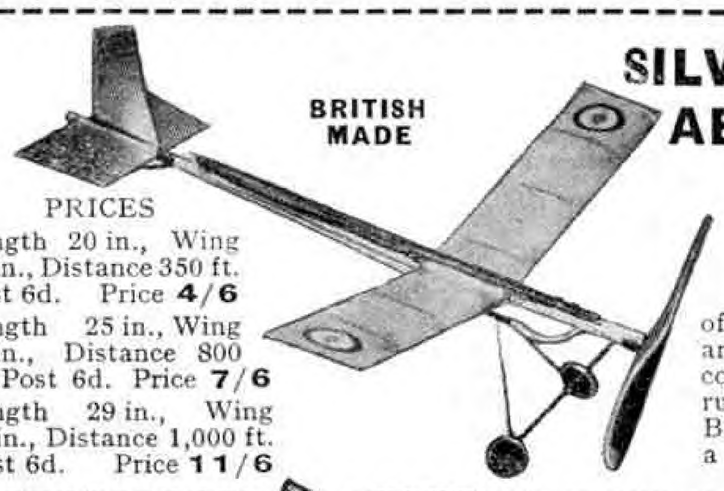
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31 in., Price **4/6.** 35 in., Price **6/-**



BRITISH MADE

SILVER FABRIC AEROPLANES

PRICES

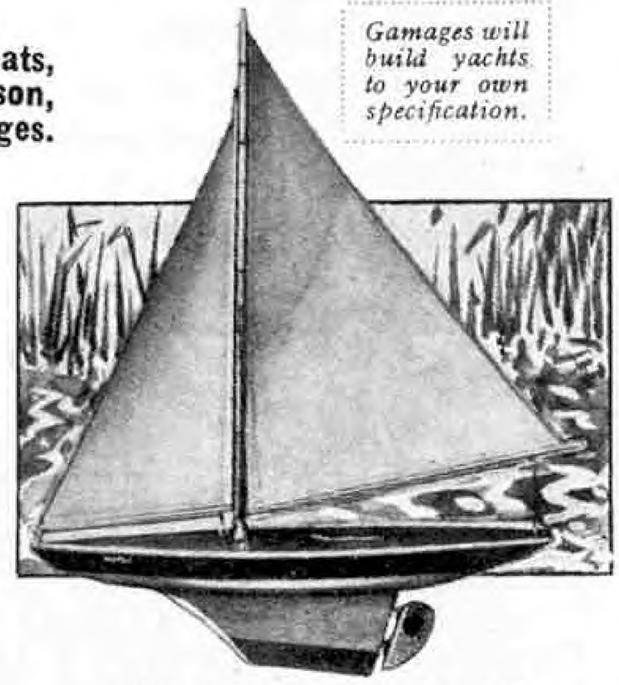
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Silver fabric aeroplanes have special double-proof, spring-wired chassis, being the very latest form of landing gear. They are fitted with a new combined rudder fin, rubber hook and skid. British made, they give a perfect performance.

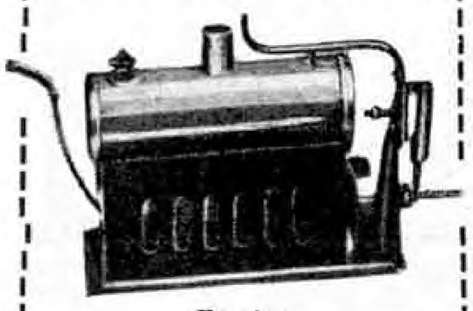
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With Collapsible Rigging

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For your Speed Boat:

MARINE ENGINE

Strongly constructed. Suitable for boats 24in. in length. Fitted with safety valve and exhaust pipe. Tested under steam. Length 5 in.; width, 1¾ in., height, 3½ in. **5/6** Post 6d.



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ONLY **17/6**

A sturdily constructed model repeating rifle—fires fifteen fibre balls at one loading. Packed in attractive carton with special scoring target. Sold elsewhere at 25/-. Gamages price **17/6** post 9d. *Foreign.*

NEW! Electric Morse Sets

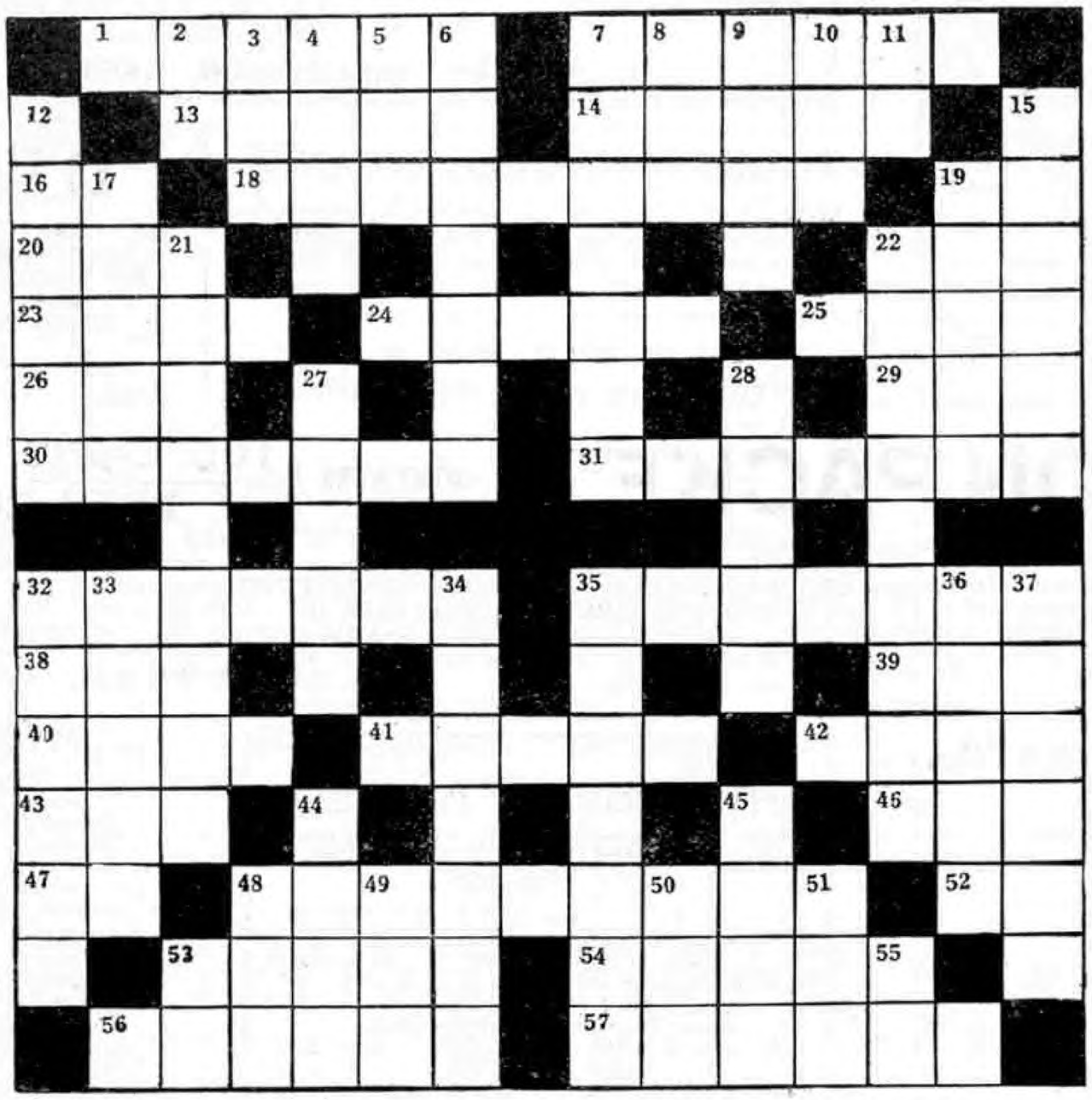
See our next month's advertisement for details of these entirely new sets. We shall be arranging special demonstrations of absorbing interest.

GAMAGES, HOLBORN, LONDON, E.C.1

Telephone: HOLborn 8484. Also at 107, Cheapside, E.C.2.

Competition Corner

APRIL CROSSWORD PUZZLE



CLUES DOWN

2. Near
3. Tag
4. Wound
5. Figure
6. Buildings
7. Conventionless Circles
8. Song
9. Tire
10. Conveyance
11. Exclamation
12. Oars
15. Collection of Musical Movements
17. Plume
19. Headgear
21. Talkative
22. Weighty
27. Nip
28. Abuse
32. Outcast
33. Pain
34. Currents
35. Kitchen
36. Penetrate
37. To object strongly.
44. Quiet
45. Regulation
48. A Wheeled Vehicle
49. Starting Point
50. Bright
51. Measure
53. Thus
55. Pronoun

CLUES ACROSS

1. A ludicrous descent
7. Dipped
13. Challenge
14. Perfume
16. Pronoun
18. Rests
19. Towards
20. The Source of Life
22. Cooking utensils
23. Periods of time
24. Ascent
25. Desire
26. By
29. Clear
30. Exertions
31. Refers to
32. Palatial Residences
35. Provider
38. Gone
39. As 5 down
40. Defeat
41. Plagiarisms
42. Objections
43. Opposite of Outs
46. Understand
47. Affirmative
48. List
52. Royal Navy (Abbrev.)
53. Biblical City
54. Outburst
56. Moulds
57. Small hole

This month's crossword puzzle will be found to follow the lines of all the previous ones we have set on this page, in that it is for amusement only, and every effort has been made to avoid unfair traps in the form of alternative solutions. The clues will be found to be perfectly straightforward, and every word used can be found in Chambers' or any other good dictionary, with the exception of one or two proper nouns that are well known to all. The rules governing the solution of crossword puzzles are so well known, however, that it is unnecessary to give any further explanation of the requirements of the competition.

Prizes of Meccano or Hornby Train goods (to be chosen by the winners) to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions, in the order in which they are opened on the morning following the closing date. In addition there will be a number of consolation prizes, and in awarding these neatness and style of presentation will be taken into consideration. These prizes will be duplicated for Overseas competitors.

Entries should be addressed " April Crossword Puzzle, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 29th April. Overseas closing date, 31st July.

Competitors should not mutilate their magazines by cutting out the crossword illustration. Instead they should make a copy of the square on the same scale, or larger, and make use of that for the Contest

Monthly Photo Contests

This month we recommence our photographic contests for the spring and summer seasons, and following the great success of these contests in recent years—the entries for 1932 were nearly twice as many as in 1931—it is intended again to throw open the contests to photographs of any subject. The prizes will be awarded to the best photographs submitted each month, irrespective of subject, size, make of camera, plate, film or paper. The only restrictions are that each print must bear a title and that the exposure must have been made by the competitor. The developing and printing may be the work of a professional.

The competition will be divided into two groups, Home, for those living in Great Britain, Ireland and the Channel Islands; and Overseas, for those living outside those areas. Each group will be divided into two sections, A for those aged 16 and over, B for those under 16; and prizes of Meccano products or photographic materials (to be chosen by the winners) to the value of 21/– and 10/6 will be awarded in each.

In addition to its title, each print must bear on its back the competitor's name, age and address. Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose.

Entries sent this month must be addressed " April Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 29th April. Overseas closing date, 31st July.

COMPETITION RESULTS

HOME

Cover Voting Contest.—1. W. P. Wiseman (Gt. Yarmouth); 2. D. Whipps (Romford); 3. L. G. Edwards (Swansea); 4. Miss A. Potton (Braintree). Consolation Prizes: R. Beirne (Seaford); J. Granger (Grange-Town); W. Hastings (Leytonstone, E.11); M. H. Helliwell (Halifax).

December Drawing Contest.—First Prizes (Section A), C. Gray (Belfast); (Section B), N. Stephenson (Huddersfield). Second Prizes (Section A), R. J. Naismith (Edinburgh); (Section B), S. Maddocks (Bedford).

OVERSEAS

September Photo Contest.—First Prizes: Section A, L. W. Humm (Geraldine, N.Z.); Section B, A. C. Davies (Victoria, Australia). Second Prizes: Section A, A. Johnstone (Via Casino, N.S.W.); Section B, E. A. Bunt (Cape Town).

Holiday Drawing Contest.—First Prizes: Section A, D. Adams (Sydney, N.S.W.); Section B, S. D. Kurlawala (Bombay). Second Prizes: Section A, S. R. Noall (Auckland, N.Z.) Section B, C. H. Brown (Victoria, Australia).

SCARCE PICCARD BALLOON & AERO PACKET FREE ! !



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FREE ! ! 20 Wonderful Stamps

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1 lb.	„ **5,000** „	**3/9** „	**4/3**
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Abroad Gift Only, 9d.

PUCKA STAMP CO., 27, NORMANDY AVENUE, BARNET.

LATEST PICTORIALS. Send me 3d., ask for selection from 4 a 1d. (30 for 6d.) and I will send you Bechuanaland, Swaziland, Trans-Jordan, Manchukuo, Angola, Monaco, Sydney Bridge, and 30 different Colonial and Foreign. Without Approvals, 6d.—J. R. Morris, 9, Audley Road, Folkestone, Kent.

THIS CASKET FREE to Stamp Collectors.
STAMP CASKET with Pictorial Coloured Hinged Lid, including Watermark Detector, Perforation Gauge, Stamp Tweezers, Transparent Envelopes, Famous Matlock Mounts and Rare Abyssinia Stamp. Just send 3d. postage (Colonial Stamps accepted) or if 4d. is sent a Powerful Magnifying Glass in Folding Metal Case will be included in Casket.



VICTOR BANCROFT, MATLOCK, ENGLAND.

Boys! Look! ask your Shop FOR "XLCR"—

THE PACKETS THAT ARE HONEST INSIDE.

Every Stamp Guaranteed Genuine: no two stamps alike in any one packet! 20 for 1d. 40 for 2d. 60 for 3d. 125 for 6d. and 24 different 2d packets of separate countries! "XLCR" Stamp Mounts are British Made in my own factory, pure tasteless gum, full size, in transparent envelopes, so that you can see before you buy. 125 for 1d, 300 for 2d. **OFTEN LICKED—NEVER BEATEN!** Be wise—insist on "XLCR" PACKETS and refuse all substitutes which are inferior. Ask your shop, but in case of difficulty drop a line to

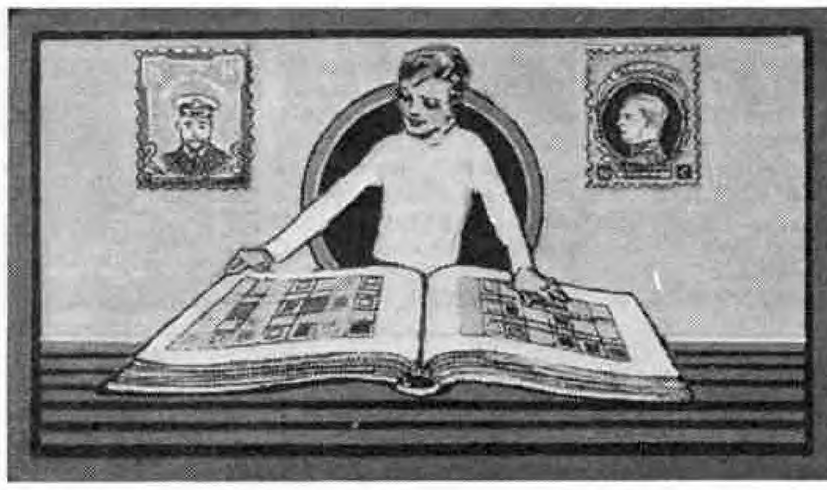


THOMAS CLIFFE, COLWYN BAY.

FREE! 100 DIFFERENT BRITISH COLONIALS FREE!

This wonderful offer of the World's most popular stamps, from most of the colonies of our Empire, includes pictorials, commemoratives, high values. Bird, ship and animal stamps, out-of-the-way stamps from Deccan, Charkara, Cochin, etc. Long sets from Ceylon, Canada, Straits, Malay, Australia, many new issues, etc. ABSOLUTELY FREE TO GENUINE APPROVAL APPLICANTS WHO SEND 2d. FOR POSTAGE.

J. BURTON, 31, ONSLOW ROAD, LIVERPOOL, 6.



Stamp Collecting

Pictorial Stamps from Papua

The new pictorial issue of stamps of Papua, or to give it its old name, British New Guinea, should prove exceedingly popular, as they provide a pictorial record of native life and customs that is worthy of a place in every stamp album. The set, which was placed on sale on 14th November last, comprises 16 values, from ½d. to £1, recess printed on unwatermarked paper and perforated 11. With the exception of the 2d., 4d., 6d., 1/- and 10/- all the stamps are in two colours and employ a common frame design, showing native carvings copied from the ornamentation on the sides and prow of a native canoe.



The general details of the designs are as follows :—½d., a Motuan girl from Port Moresby. 1d. (illustrated), a young boy, Steve, son of Oala, in native dancing costume. Oala is one of the most progressive natives in the territory, owning his own sawmill and motor lorry. The giant headdress worn by the boy is composed of Bird of Paradise plumes. 2d., Bird of Paradise resting on a boar's tusk. 3d., a dandy of the Koitapua tribe. 4d. (illustrated), a young native mother in the doorway of her hut. In the background can be seen one of the famous lakatoi, or native boats. The tall cylindrical object on the right of the design is a native drum. 5d. (illustrated), a masked dancer from the Kerema Gulf. His costume has been specially made by the males of his village. as it is a custom that the women of the village must not see the costume until the festivities actually begin. The whole mask is of one piece and the figure at its top is intended to represent a hornbill.



6d., a native woman carrying her children. One child is in her arms and the other slung in a network bag on her back. In the background a native craftsman can be seen shaping a canoe paddle. 9d., a native shooting fish. Although this method of killing fish for food has been practised by the Papuans for many hundreds of years, the stamp design seems to be inspired by the 2c. British Guiana Centenary Stamp of 1913. 1/-, a ceremonial platform (or Dubu) used for special feasts. Note specially the carved posts supporting the platform. These platforms have a sacred significance and are supposed by the natives to be the home of the spirits of the departed. The names of the 10 post towns of the territory are printed around the frame of the stamp as follows :—Buna Bay, Abau, Kulumadau, Losuia, Kokoda, Bwagaoia, Port Moresby, Ioma, Daru and Samarai.



1/3, the lakatoi. This specially interesting craft has been featured on Papuan stamps for over 30 years. It is the trading vessel used to carry pottery from Hanuabada to other places along the coast. The voyage is made once a year, the lakatoi being constructed by lashing together from six to 10 dug-out canoes. 2/-, objects of native art from the Purari Delta. 2/6, a native potter from Hanuabada. 5/-, a portrait of Sergeant-Major Simoi, the only native-born policeman to reach the rank of Warrant Officer. He joined the Force in 1899 and has a wonderful record and endurance. 10/-, a native lighting a fire by the old-time friction method. £1, a typical native hut from the Purari Delta.



Equipping the Stamp Collector—(III)

In the February and March "*M.M.'s*," under this heading, we devoted ourselves to cataloguing the paraphernalia of the stamp collector, to equipping him physically, as it were. The mental equipment of the collector is no less important. The collector who develops an "enquiring mind" is certain to derive vastly more pleasure from the hobby than his chum whose concern it is simply to add stamps to his collection and not to trouble about the story behind them. A knowledge of the technical expressions that are commonly used is essential, and in this article we propose to explain briefly the more important terms used in describing stamps.



It is doubtful whether any expression puzzles the new collector more than the description "mint." He sees it frequently in stamp advertisements, and in a vague way believes that it means something rather better than "unused." Actually it is used to denote a stamp that is perfect, that possesses all the delicate bloom of the condition in which it left the printers. Let its surface once be rubbed, a perforation tooth creased or the glaze of its gum defiled by contact with a mount, and it ceases to be mint and becomes merely "unused," with a somewhat reduced value.

"Overprints" and "surcharges" are apt to be confusing, but a clear understanding of the functions of the two features will render the terms quite simple. Overprints are applied to a stamp to vary the purpose for which it was issued, as, for example, the Maltese issues of 1926. Originally these were inscribed "Postage," but in 1928 they were made available for fiscal purposes and overprinted "Postage and Revenue." There have been innumerable instances of postage stamps overprinted for air mail use. A surcharge alters the value of a stamp. It is a practice commonly adopted following a change in postal rates. The stocks of certain value stamps may be insufficient to meet the sudden demand involved in the change, and temporarily the shortage is met by surcharging other values of which stocks are ample.

In one sense "Pre-cancels" are overprinted stamps. In certain countries—notably the United States of America—it is an increasingly common practice to issue stamps to business houses with the name of the post office printed on the stamps. This serves as a cancelling post mark, and saves time in the post office itself. It avoids the necessity for putting large batches of printed matter through the cancelling machine.

Another device that is saving time for the Post Office is the "franking meter," a machine that is rapidly achieving universal adoption. This machine is used by business houses under license from the Postal authorities, and does away with the use of postage stamps. The machine is set to give franks to an amount pre-paid by the licensees. In addition to printing on the envelope the value of the frank, it prints also a postmark and, if the licensee wishes, an advertising design. Each machine can be identified by its registered number embodied in the printed frank. For example, franks bearing the Liverpool postmark and (*Continued on page 315*)





THE "NEW ISSUE PACKET" FREE

This wonderful packet will be given **FREE** to all who apply for my famous Approval Sheets and enclose 1½d. postage. It contains **FINE PICTORIAL GABOON** (just issued). **NEW ISSUE ANDORRA,** a fine set of newly issued **CANADA,** including the **OTTAWA** Conference stamp, **U.S.A.** Bi-centenary of Washington, 1932; set of **UNION OF S. AFRICA,** pictorials, including re-issue of 2d., with war memorial added; new issue of **STRAITS** and **MALAY,** 5c. brown; a **FINE ICELAND** pictorial (see illustration); **RUANDA-URUNDI,** new pictorial; **TURKEY,** new head issue, etc. 50 Stamps in all. Have you had my 70-page illustrated booklet, price 1d.? Senders of stamp collectors' names receive an extra set free.

H. C. WATKINS, "M" DEPT., GRANVILLE ROAD, BARNET.



ALBUMS, PACKETS & ACCESSORIES

Our new 1933 Price List is now ready. Post Free on application.

£2 GIVEN AWAY EVERY MONTH to purchasers from our world-famed Approvals Sheets. Send for approval sheets and full particulars to Department 220.

ERRINGTON & MARTIN

South Hackney, London, E.9. *Established 1880.*

BECHUANALAND PICTORIAL ! 15 SHIPS & AEROPLANES ! ! 30 ALL DIFFERENT ! ! !



FREE!

This gift will prove to be the **Sensation of 1933!** There are fine stamps showing **Sailing Vessels, Native Boats, Windjammers, Liners, Monoplanes,** and **Biplanes.** There are also 30 all different, used and mint, Pictorials. British Colonials, Commemoratives. Finally there is a **new Bechuanaland Pictorial!** This amazing gift is **FREE** to **Genuine Applicants** for our Approvals who send **2d.** postage. Obviously **this is the Offer Supreme.** Write at once!

SUPER STAMPS,
LALESTON, VANBRUGH HILL, LONDON, S.E.3.

AVIATOR PACKET FREE ! !

Contains **508 Unsorted Foreign Stamps,** many scarce, from **Roumania** (Aviator Air Mail), **Finland** (lion), **Turkey** (**Baghdad** issue), Japan 1899, beautiful Fr. Colonial, **Chili** 1878, **Egypt,** etc. Send 2d. for postage and request our **Famous Extra-Large-Discount Approval Sheets.** (Abroad 6d. P.O.)

LONGBOTTOM & EASTICK,
59, HOLDENHURST ROAD, BOURNEMOUTH.

6 Mint Colonials Free

to all sending for good class selections of Colonials and Foreign, containing many New Issues and Pictorials.

E. S. JAMES
CONISTON, DORKING, SURREY

THE FIRST STAMP EVER ISSUED

was the British 1840 Penny Black. Against a P.O. 1/9 we will send you a genuine postally-used copy of this interesting stamp (cat. 6/–); for a further 5/– you may have a copy of its companion stamp, the 1840 2d. Blue (cat. 20/–). Another "classic" which every Collector should have is the **Cape of Good Hope** 4d. blue **Triangular** (cat. 15/–), and a nice copy will be supplied at 5/–. Superb approvals of any country against satisfactory English references or a deposit. **Full Lists Free.**
NORRIS & CO. (Dept. M), Norwood, London, S.E.19.

100 SUPER DIFFERENT USED STAMPS FREE

To all applicants for my approval books of British Colonials and Pictorials priced from ½d. each less 25% discount, I am sending the above gift FREE. Write now.

ERIC J. WATTS,
48, LONDON ROAD, NORTHAMPTON.

Afghanistan Packet FREE

A fine packet of all **different Stamps,** containing a fine unused **Afghanistan,** new issue; **Abyssinia,** 1932, large pictorial, unused; **Yemen,** 1931, unused; **Albania,** 1930, pictorial, unused; **Algeria,** high value; **Russian North West Army Stamp**; **Tunis,** high value; **Siam,** head; **Portugal,** 40c.; **Travancore,** etc. Free to all asking to see my famous Approval Sheets, and **enclosing 2d. for postage and packing** (abroad 3d.). Albums from 1/4 upwards.

S. HAMMOND, 2, CHESHAM FIELDS, BURY, LANCS.

WATCH THIS SPACE

for Bargain Packets every month. This month I offer the following:—

No. 1. 100 diff. Stamps, guaranteed to catalogue **at least** 12/– 1/–
No. 2. 500 Mixed Stamps, unpicked. Plenty of fun sorting these ... ... 6d.
No. 3. 100 Stamps from my Office Mixture. On paper, as received. Contains high values 1/–
Postage extra.

W. A. JONES, 39, NEVILLE ROAD, CROYDON.

ENGLISH £1 & 10/- STAMPS

These two stamps (issued and used for a special purpose) with eight others, including one nearly **90 YEARS OLD** and other **OLD** English postage stamps **GIVEN AWAY** free of charge to genuine applicants for selections of duplicate stamps on approval.

HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

SHOWERS

of requests for my 4 a 1d. selections arrive by every post. Have you written for one yet? Just the thing to occupy a rainy day.

L. D. MAYNARD
78, RICHMOND STREET, SOUTHEND-ON-SEA

Three Caymans Centenary Free to genuine approval applicants.—Sanders, Newlands Ave., Southampton.

Stamps! Packet 500 on approval. Pick any at ¼d. each.—Wyk, 576, Chester Road, Manchester.

PICTORIALS, King's Heads—Colonial or Foreign—one farthing upwards. Wonderful value. Send for selection.—Jal, 246, Dollis Hill Lane, London, N.W.2.

50 BRIT. COLONIAL FREE. Request Approvals. Lists free.—Cranwell, 54, Churchill Rd., London, N.W.2.

100 DIFFERENT STAMPS FREE. Send for ½d. Approvals.—Cox, 21, Dennis Mansions, Westcliff.

KING'S HEADS, Colonial and Foreign Duplicates for disposal. One Farthing per stamp. Send postcard for trial.–Philatelist, 32, Josephine Avenue, Brixton, S.W.2

QUALITY NOT QUANTITY. 40 diff. Brit. Cols., 7d. post free.—Lucas, 60, Park Street, Bristol.

75 Superior Stamps! Colonials, Pictorials, Packet of Mounts, to genuine "Bargain" Approval applicants enclosing 1½d. stamp.—Lovell, 96, Gosterwood Street, Deptford.

6 MINT BRITISH COLONIALS FREE 6

ZANZIBAR, KENYA, TURKS and CAICOS IS., MOROCCO AGENCIES, SOUDAN and CAYMAN IS. Ask for the No. 200 Packet.

EDWARD SANDELL,
10, EVELYN GROVE, SOUTHALL.

24 AIR STAMPS FREE

This splendid packet of 24 **All Different Air Stamps** will be sent free to **Genuine** Applicants for my BETTA Approvals.

LARGE DISCOUNTS GIVEN.

Send 3d. to cover postage and packing.

ALIX HARLAND (Dept. A.1), 4, Featherstone Buildings, High Holborn, London, W.C.1.

Cellulose Spraying at Home

Most boys have attempted to renew the enamel on their cycles, but few have succeeded in achieving a result that can be compared with the perfection of the original finish. With the "Sprayon" Cellulose Outfit it is claimed that invisible repairs to damaged paintwork can be effected without difficulty, and the method of achieving this is fully explained and illustrated in a booklet entitled "*Machine-gun Methods*," published by The County Chemical Co. Ltd. This booklet also describes the striking decorative effects that can be secured on household articles with "Chemico" Crackle Cellulose.

There is a great deal to interest both boys and their parents in this well-produced booklet. A copy will be sent post free to any "*M.M.*" reader who applies to The County Chemical Co. Ltd., "Chemico" Works, Birmingham, 5.

"Holiday Haunts"

(G.W.R. 6d. net.)

The 1933 edition of "*Holiday Haunts*," the Great Western Railway's popular handbook, which is just to hand, has been entirely re-designed, and in its improved form is easily the best that has been produced. The 300 illustrations, all beautifully reproduced in photogravure, form by far the finest collection of views of the West ever included in a book of this kind, and they give one an irresistible desire to visit the many beauty spots.

The book is in seven sections, and the double page photogravures in each section are representative of the area dealt with. The pages of letterpress give vivid pen pictures of nearly 800 spas, resorts, towns, villages and hamlets. To aid the prospective holiday-maker still further the book contains over 8,000 addresses of hotels, boarding houses, private apartments and farmhouse accommodation, so that every taste is amply catered for. A list of golf courses and other useful information for travellers is also included.

The book is claimed to be the West's "best seller," and it certainly seems has been responsible for the attraction of more visitors to that part of the country than any other single agency. This is borne out by the fact that many of the addresses in this edition have consistently appeared in the Guide since it was first published in 1906.

Round the World

The pages of the "*M.M.*" offer you a world wide market. For the small charge of 16/– per column inch, 2¼ in. in width, your advertisement is brought to the notice of tens of thousands of potential customers each month. Every advertisement in the "Meccano Magazine" is read by more than 150,000 readers in all parts of the world.

Rates and Specimen Copy on request.

Advertisement Manager,
"Meccano Magazine"
BINNS ROAD OLD SWAN LIVERPOOL 13

FREE! 7 GREECE pictorials (1927)

To Genuine Applicants for my "Peak" Approvals.
S. BACKHOUSE, 61, WARNER STREET, DERBY.

1000 DIFFERENT STAMPS 1000

ON APPROVAL

from which you may select any 100 for 3/–. This selection is not made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/– each. For 3/– you have the opportunity of choosing 100 stamps of the catalogue value of 20/–or more.

H. HARDY,
39, Rosebery Gardens, Hornsey, London, N.8.



Stamp Gossip

and Notes on New Issues



British Centenary Commemoratives

In our February issue we referred briefly to the issue of stamps in celebration of the completion of 100 years of British rule in the Falkland Isles. We had been told to expect a really beautiful set, but now that the stamps are available it is indeed difficult to do justice to a series that is easily the best-produced British set for many a long day.

Gibbons' Stamp Monthly describes the

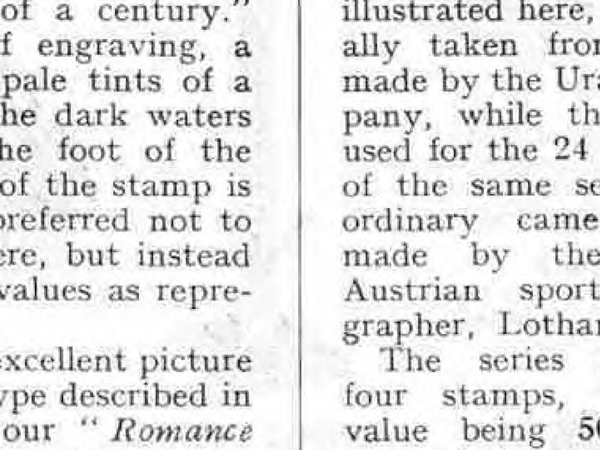


4d. value, a view of a sunrise over South Georgia, as "the stamp of a century." It is a masterly piece of engraving, a mountain scene with the pale tints of a morning sky reflected in the dark waters of the bay nestling at the foot of the mountain. The colouring of the stamp is so delicate that we have preferred not to attempt to reproduce it here, but instead to show the 1½d. and 3d. values as representative of the series.

The 1½d. value gives an excellent picture of a whale catcher of the type described in the December "*M.M.*" in our "*Romance of Whaling*" series. It is, in our opinion, the best ship stamp ever produced. The 3d. value shows a map of the islands, and is specially interesting in that the actual degrees of latitude and longitude are indicated, a feature that we do not recall in any previous map stamp design.

The general details of the remaining designs are as listed in the February "*M.M.*" The complete issue comprises 12 stamps, from ½d. to £1 denominations, perforated 12 and watermarked Script C.A. The set of seven low values, ½d. to 6d., would make an interesting and not too costly addition to any young collector's album.

We illustrate also the design used for the Cayman Islands issue commemorating the centenary of the establishment of the local governing court, the Assembly of Justices and Vestry. The neatly balanced design shown was used for each of the 12 stamps in the series. Its most interesting feature is the first stamp appearance of King William IV in the stamp gallery of royal portraits.



Record Air-Stamp Price

A new high-water mark in air stamp prices was reached at auction in New York when a specimen of the 24c. U.S.A. 1918 air stamp with inverted centre was sold for $2,750, or £350 at the current rate of exchange. The name of the purchaser was not disclosed, but it is believed that the stamp ultimately will find a home in Great Britain.

Only 100 copies of this stamp exist, and two years ago it was predicted by experts that within a very short time the value would rise to the neighbourhood of $5,000. A block of four was purchased for $15,000 in July, 1931, by an American collector, Mr. John Aspinwall.

A Film Inspiration

Inspirations for stamp designs have been sought and found in many curious places, but we imagine that never before has a "still" from a cinema film been "lifted" for the purpose. The design of Austria's 12gr. winter sports stamp, illustrated here, was actually taken from a film made by the Urania Company, while the designs used for the 24 and 30gr. of the same series were ordinary camera views made by the famous Austrian sports photographer, Lothan Rubelt.



The series contained four stamps, the high value being 50gr., and was valid for postage until 31st March. Only 50,000 sets were printed, and these were sold at double face value, the premium being devoted to the funds of the International Skiing Federation.

* * * *

Nicaragua has issued two sets of stamps to celebrate the opening of the new railway between San Jorge and the port of San Juan del Sur on 18th December. One set is for general use and the second for aerial post. Only 1,000 copies of each stamp were printed, the designs consisting of scenes along the route.

* * *

We understand that the printing of the projected new general issue of stamps for New Zealand will be placed in the hands of Waterlow & Sons Ltd., London. With the exception of the 9d. value, which is to be lithographed, the whole series will be in photogravure.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations of our stamp pages have been made.

New Railway Designs

Egypt's short set commemorating the International Railway Congress held at Cairo in January is of special interest to railway enthusiasts, as the designs of the



four stamps provide a brief historical sketch of the development of the locomotives of the Egyptian State Railways. The 5 mils. value shows a locomotive of 1852, the 13 mils. a locomotive of 1859, 15 mils. a locomotive of 1862 and the 20 mils. a locomotive of 1932.

Each stamp is in the rectangular format shown in our illustrations of the 13 and 20 mils. stamps, and bears the inscription "Congres International des Chemins de Fer 1933" in French and Arabic.

Although it was intended that the stamps should remain in circulation for a period of three months, only 200,000 of the 5 mils. and 50,000 of each of the other values were printed.

* * * *

The United States will shortly issue a 3c. stamp in honour of the late Mr. Calvin Coolidge, the former President.

Competition Result

December Stamp Contest.—1. G. A. Batty (Liverpool); 2. W. P. Short (Taunton); 3. C. Dinsdale (Grantham); 4. H. Harrison (Milnathort). Consolation Prizes: L. Goldsmith (Lowestoft); P. P. Marlow (Yeovil); J. B. Pinnock (Bedford).

Equipping the Collector—(*Cont. from page 313*)

the number *N6* have come from our publishers' office.

There are several types of machine approved by the Postmaster-General for use in Great Britain, the principal being the Neopost, the Pitney-Bowes and the Universal, distinguished by the letters *N*, *PB* and *U* respectively. Each post town maintains its own register of licenses, and thus the number *N6* is common to many firms in different parts of the country. The name of the post town is an essential feature to secure complete identification of any particular frank.

HORNBY SERIES

HORNBY ACCESSORIES

GAUGE O

There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.



TUNNEL No. 0 (Straight)
Length 6 in., width 6⅛ in.
Price **1/6**

TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width 6¼ in. (as illustrated).
Price **2/-**

TUNNEL No. 2 (Straight)
Length 15⅝ in. Width 9½ in. Price **4/-**



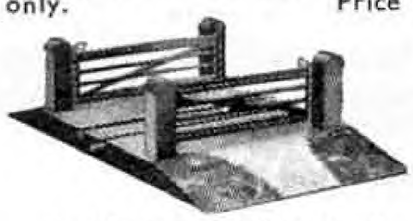
TUNNEL No. 5 (LEFT-HAND CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks.
Base measurement: 15⅞ in.x14¾ in.
Length of track 17¼ in. Price **7/6**

TUNNEL No. 6 (RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement 15⅞ in.x14¾ in.
Length of track 17¼ in. Price **7/6**



TUNNEL No. 3 (Curved)
Length 13 in. Price **4/6**

TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**



LEVEL CROSSING No. 1
Suitable for a single track only and has gauge O rails in position.
Price **3/6**

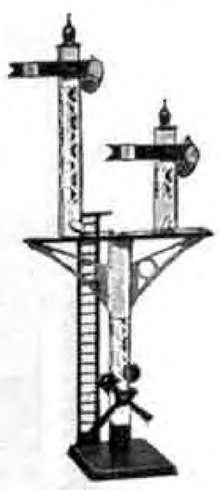


LEVEL CROSSING No. 2
Measures 13½x10¼ in., with two tracks of gauge O rails in position. Price **5/6**

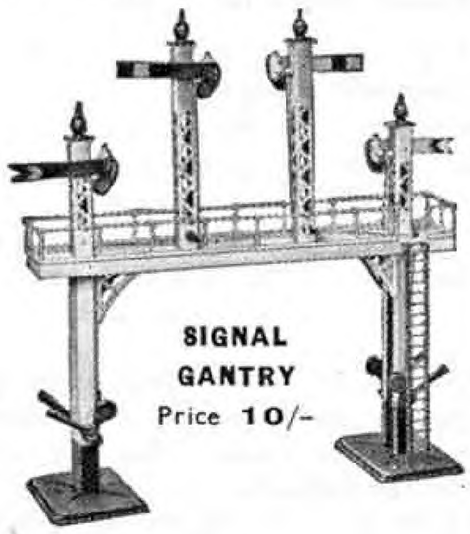
LEVEL CROSSING No. E2 (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price **7/6**



STATION No. 2
Excellent model, beautifully designed. Built up in three detachable sections.
Length 2 ft. 9 in., breadth 6 in., height 7 in. Price **10/-**



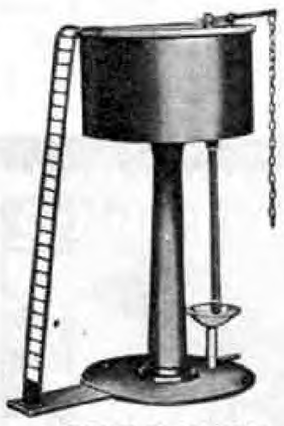
JUNCTION SIGNAL
"Home" or "Distant," Signal arms operated by levers at base. A very realistic model.
Price **6/-**



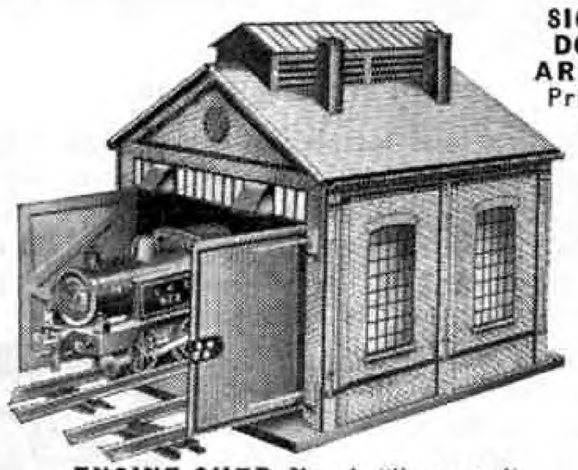
SIGNAL GANTRY
Price **10/-**



SIGNALS, DOUBLE ARM No. 2
Price each **3/-**



WATER TANK
Fitted with flexible tube and valve lever.
Price **8/6**



ENGINE SHED No. 1 (illustrated)
This Shed will accommodate Locomotives and Tenders of the M Series and No. 1 Tank and No. 1 Special Tank Locomotives.
Price **15/-**

ENGINE SHED No. 2
This Shed will accommodate any Locomotive and Tender in the Hornby Series.
Price **22/6**



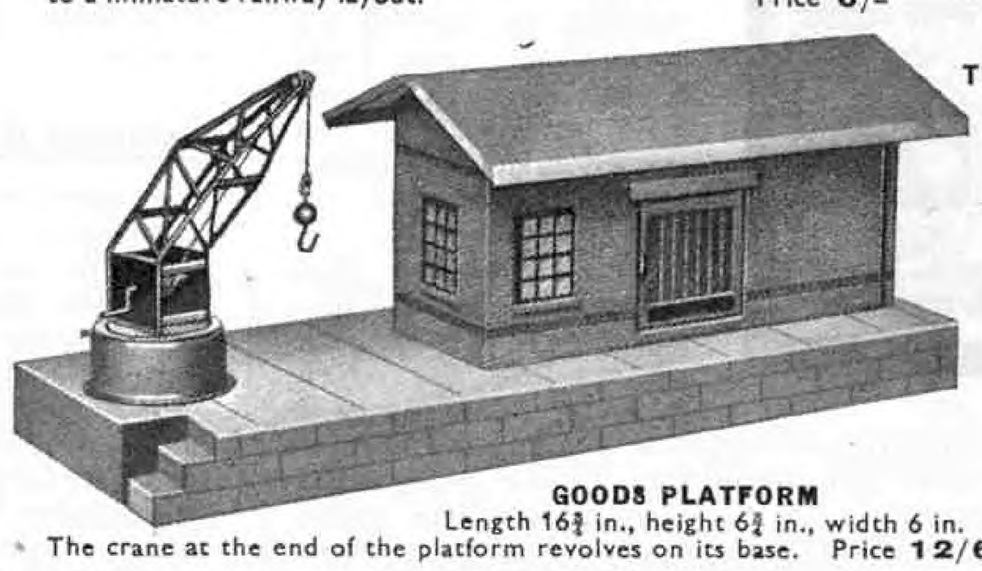
SIGNAL No. 1
Packed in pairs (one "Home," one "Distant").
Price, per pair **3/3**



STATION No. 1
Length 16¾ in., width 6 in., height 6 in. This Station is a well-made model, richly finished in bright colours. By placing several of these Stations at intervals along the track, and using the Railway Station No. 2 as the main terminus, a very realistic effect is given to a miniature railway layout.
Price **6/-**



TURNTABLE No. 2
Price **4/6**



GOODS PLATFORM
Length 16¾ in., height 6¼ in., width 6 in.
The crane at the end of the platform revolves on its base. Price **12/6**



Cutting No. 4

CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 15⅜ in., width 15 in. Price **6/-**

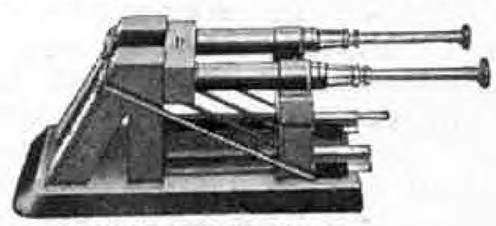


Two No. 1 and one No. 2 Cuttings are illustrated here.

CUTTING No. 1 (END SECTION)
(illustrated)
Base measurement: Length 7 11/16 in., width 6 in. Price, per pair **3/-**

CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1), between which they are fitted.
Base measurement: Length 10¼ in., width 6 in.
Price **2/-**

CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**



BUFFER STOPS No. 2
(Hydraulic type). Price **5/6**



SIGNAL CABIN No. 1
Finished in colours. Price **2/9**

SIGNAL CABIN No. 2 (illustrated)
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price **4/6**



No. 1 FOOTBRIDGE, WITHOUT SIGNALS
Price **4/-**

No. 1A FOOTBRIDGE, COMPLETE WITH SIGNALS Price **4/9**

No. 2 FOOTBRIDGE, COMPLETE WITH DETACHABLE SIGNALS
(as illustrated). Price **7/6**

Signals only (for Footbridge No. 2)
Price, per pair **3/9**

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

Two P. & O. Liners—(*Continued from page 251*)

conditions, and she is the first P. & O. liner to be fitted with gyro-compass equipment. This includes a Sperry master compass and gyro pilot, and it supplements an outfit of magnetic compasses. Communication between the navigating bridge and the engine room is provided by electrically operated engine room, docking and steering telegraphs, and the power to operate these is obtained from primary batteries capable of working the apparatus for a year without renewal. Thus the telegraph equipment is worked entirely independent of the ship's electric mains.

The service on which the "*Strathnaver*" is engaged involves passing through the Suez Canal, and for making this portion of the journey at night when necessary, the ship is equipped with a 20-in. Suez Canal projector installed in a special compartment in the forecastle. It is mounted on a carriage that can be moved forward so that the beam of light from the lamp shines through a special door in the upper part of the stem. The beam is obstructed down the middle so that it shines only on the respective banks of the canal.

During her trials in August last the "*Strathnaver*" attained a speed of slightly over 23 knots, and when running on one turbo-generator taking steam from two of her four main boilers, she easily maintained a speed of 15½ to 16 knots. The ship is now engaged in the P. & O. England-Australia service.

Great Ports—(*Cont. from page 256*)

first-class accommodation for the storage and selection of all kinds of fruit cargoes. Wide single and two-storey sheds are available, and are conveniently situated for direct distribution of the fruit by rail or road. The ample facilities enable ships to effect a quick "turn round," and on one occasion a steamer discharged her cargo of 20,000 packages of fruit and, after loading 2,100 tons of coal, sailed in less than 60 hours after arriving at the port.

At Merklands Quay there is an extensive cattle lairage, with deep-water berths where liners and coasting steamers can discharge direct into the lairage. As many as 231,982 head of cattle have been landed in one year.

The port possesses excellent facilities for the repair and overhaul of any of the large ocean-going ships that visit it. The Trustees have constructed three graving docks, one of which is 880 ft. long, and has an entrance width of 83 ft. and a depth at high water on the sill of 26 ft. 6 in. Naturally, as the greatest shipbuilding centre in the world, the shipment of machinery and the fitting-out of vessels are fully provided for by cranes up to a lifting capacity of 175 tons.

The continual improvement of the river by the successive Trustees has resulted in the original bed of the river being lowered about 30 ft. in the lower reaches at Glasgow harbour, and the bed is now practically level from Glasgow to Port-Glasgow. The cost of this dredging improvement work amounts to £2,000,000, and the maintenance of the dredging has cost an average of £58,000 a year. To make the navigation of the river by night as safe and easy as possible the channel is lighted by numerous light towers and gas buoys, which give it the appearance of a public street in a well-lit city.

The Trustees of the Clyde Navigation have for a long time had in view an extension of the harbour to the west of the city, on the south side of the river, at Shieldhall. Over 40 years ago they acquired their first block of ground there, and this has been added to from time to time until they now hold an area of about 700 acres lying between Shieldhall and Renfrew, with a river frontage of about two miles. The scheme for utilising this ground provides for six large tidal docks or basins, leaving the river at a convenient angle. When fully completed these docks will add six miles to the quayage of the port, and additional graving dock accommodation may also be included in the scheme. The first tidal dock of the scheme was opened by the King in 1931 and named by the Queen "King George V Dock." The dock and adjoining riverside quay, designed to accommodate the largest class of ocean-going vessels trading to the port, have a total quay length of almost 1¼ miles, the dock itself having a width of 350 ft., a depth at low water of 32 ft., and at high water of 42 ft. The whole of the east quay of the dock is allocated to vessels trading to Australia, China and Japan. The other docks of the scheme will be constructed one at a time as the traffic of the port requires, and this will afford an opportunity from time to time of reconsidering details of construction and equipment in view of any development of shipping previously unforseen. The whole scheme, it is expected, will provide for the expansion of the port for many years.

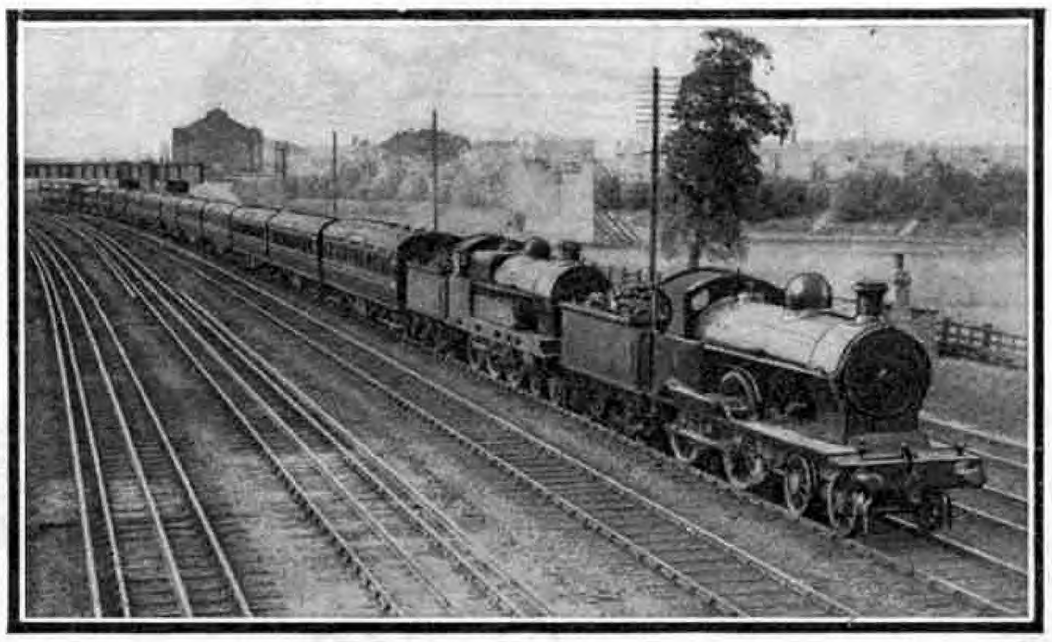
We are indebted to the Clyde Navigation Trust for much of the information contained in this article.

A Turbo-Alternator—(*Continued from page 257*)

to the windings, the leads being laid in a groove cut in the rotor shaft.

The windings of both the rotor and stator are kept cool by a very efficient ventilation system, which is provided by fans. In the case of the Battersea plant a special arrangement of cooling and ventilating is necessary owing to the extremely high voltage and rate of revolution of the rotor. This system makes use of a surface cooling condenser, through the tubes of which the make-up feed water for the boilers is passed. Fans circulate the same air continuously through a system of ducts in the foundation block on which the alternator is mounted, and then over the tubes of the condenser. The heat abstracted by the condenser raises the temperature of the boiler feed water, so turning to profit the heat that otherwise would be wasted.

Double-heading on the L.M.S.R.



An up express passing Kenton. The pilot engine is of the "Precursor" class, No. 5273 "Jason," while the train engine is an unnamed "Claughton," No. 5989. Photograph, Railway Photographs, Liverpool.

What Shall I Be?—(*Continued from page 273*)

promotion are in no way diminished.

It is impossible to give any idea of the wages in the various departments of the railway service. When joining, a boy of 17 usually receives a weekly wage of about 10/–, and this increases as he grows older and secures promotion.

The growing importance of the thorough study of transport problems of all kinds make it advisable that railway employees should become associated with the Institute of Transport. This Institute was founded in 1919 for the purpose of promoting the advancement of the science of the art of transport and of encouraging generally its development and improvement, and the scope of its work is not confined to railway transport.

As usual in bodies of this kind, there are several degrees of membership of the Institute of Transport. The highest is that of Corporate Membership, to which belong those who are at least 30 years of age, and who, for at least 10 consecutive years have held positions of responsibility with transport organisations. The qualifications for Associate Membership, the next grade, are a minimum age of 25 years, service in good positions in the transport world for at least five consecutive years, and the passing of an examination; but in certain cases exemption from the examination, or part of it, may be obtained. In each case candidates must be nominated by at least five Corporate Members, and they are elected by the Council of the Institute. In addition to these two grades of membership, provision is made for the election of Honorary Members and of Associates.

The section that is of interest to boys in the early stages of a railway career is that of Student Membership, and they may be elected to this grade on satisfying the Council in regard to their character and education, the evidence required being success in recognised examinations of Matriculation standard. Students of the Institute pay an annual subscription of one guinea if they reside within Great Britain and Ireland, or of 10/6 if they live elsewhere; and they are eligible for the Institute examinations qualifying for Graduateship, the next grade of membership. These examinations are held at various local centres, and those who pass them may be elected Graduates on reaching the age of 21 years. Then a period of active service in some field of transport, and success in passing the Institute's examinations, are required before election to Associate Membership, the preliminary to Corporate Membership.

Full information concerning the Institute of Transport may be obtained from The Secretary, Institute of Transport, 15, Savoy Street, Victoria Embankment, London, W.C.2.

The Greatest Bridge—(*Continued from page 261*)

contains 26,474 parallel wires each .196 in. in diameter. The wire used in the cables is of high-grade steel and has a strength of 240,000 lb. per sq. in., more than double that of the wire used in the cables of the Brooklyn Bridge. The 26,474 wires forming each main cable were grouped by workmen on the footbridge into 61 equal strands, each containing 434 lengths or 217 loops of wire.

Immediately the cable work was completed a start was made on the erection of the floor steel, and this work was carried on at four different points, the main span being begun from the river side of the towers, and the side spans from the landward side of the towers. The travellers used for erecting the bridge deck each consisted of two stiff-leg derricks coupled together, the advantage of this arrangement being that by using two derricks to lift the 62½-ton main floor beams, lighter, shorter and more speedy booms could be employed than if single very large travellers had been used. In fact the arrangement reduced the erection time on this part of the work by more than half. When a floor beam had been lifted and placed in position, the two derricks worked separately until the next beam was required, each derrick during the interval lifting and placing in position half of the cross-beams and the other steelwork forming the deck panel. Thus panel by panel the steelwork of the deck was laid.

The steel for the bridge deck was conveyed to the site in the same manner as the steel for the towers. The barges loaded with steel for the main span were moored to other barges anchored beneath the deck panels in course of erection, and travellers on the bridge decks then hoisted the material and placed it in position in the bridge. The steel for the side spans, which connect the main span with the approach roads, was taken to the tower foundation at New Jersey and to the special wharf near the New York tower. At these points stiff-leg derricks overhead hoisted the steel up to the bridge deck and loaded it on to small cars, and by utilising certain beams in the deck formation as rails, the cars were pushed along and the steel conveyed to the side span travellers, which placed it into position. Compressed air riveters were employed and 312,500 rivets were used in erecting the bridge deck.

The stranded steel ropes that had been used to support the footbridges during the making of the main cables were removed, cut up into suitable lengths and used to suspend the deck from the main cables. The network of steel forming the deck was then filled in with concrete, special forms or moulds being made for this purpose; and a mechanical finishing machine, 29 ft. wide, smoothed out the roadway concrete.

At the New York end the bridge terminates about 100 ft. above the land, and the bridge approach was therefore built in the form of a long ramp, 60 ft. wide. When the layout of the New York approach to the bridge is ultimately developed the present 60 ft. roadway will be flanked by two 30 ft. side roadways on the outer side of which will be footwalks, making the total width of the main ramp 145 ft. The construction of the New Jersey approach to the bridge presented an entirely different problem, for there the bridge terminates about 50 ft. below the top of the rocky cliffs. A deep cut, at a fairly steep gradient, was excavated to carry the approach roadway up to the surface.

Air Line Companies—(*Continued from page 271*)

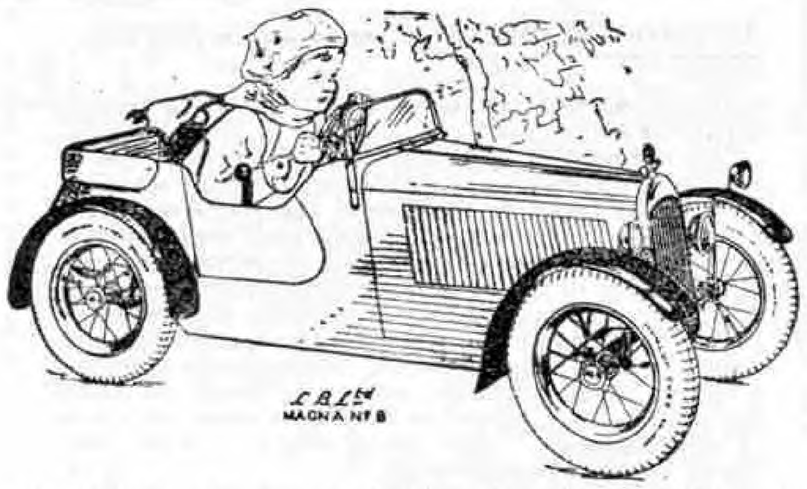
a minute examination, after which any necessary repairs are made.

The engine overhaul is another department by itself, and all engines are inspected without exception every 300 hours. They are taken down completely, and all the 1,610 individual parts of which they are built are carefully examined. Vital moving parts, such as pistons, crankshafts, bearings, valves, etc., are examined under a magnifying glass that enlarges to 125 diameters. When reassembled the engine cannot be distinguished from a new one, but before it is installed in an aeroplane it is operated under its own power and at cruising speed for a period of at least 10 hours.

T.W.A. are particularly fortunate in their pilot personnel, for many of the regular pilots employed are men who are well known among American aviators for their fine flights. Colonel Lindbergh, of course, heads the list, for he was the first man to make a solo flight across the Atlantic. Another well-known T.W.A. pilot is E. Smith, who was the first civilian to fly across the Pacific Ocean from Oakland, California, to the Hawaiian Islands, and who still flies on his regular schedule. The company also employ Alton Parker, who flew with Byrd to the South Pole. Still another veteran pilot is Arthur C. Burns, who is nearing his 20th year in aviation, and has just completed his millionth mile of flying. He was the first passenger pilot in the United States.

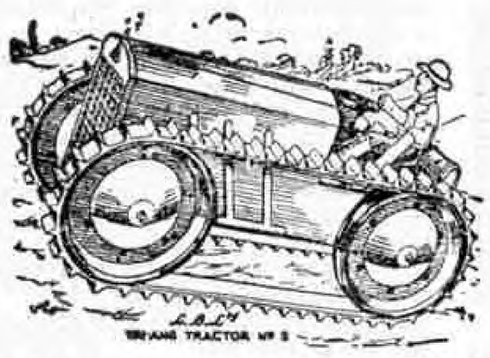
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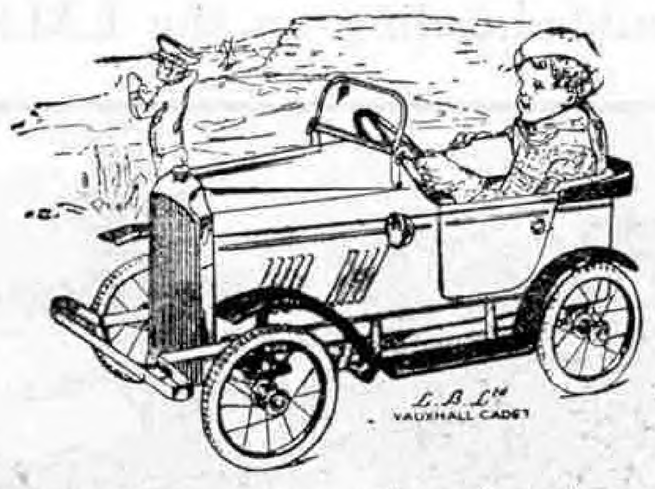


MAGNA No. 8. A reproduction of modern sporting cars. Wood body, model pressed radiator, Band brake, tubular front axle, ball-bearing back axle. 2½" balloon pneumatic tyres on tangent spoke wheels. Price **105/-**

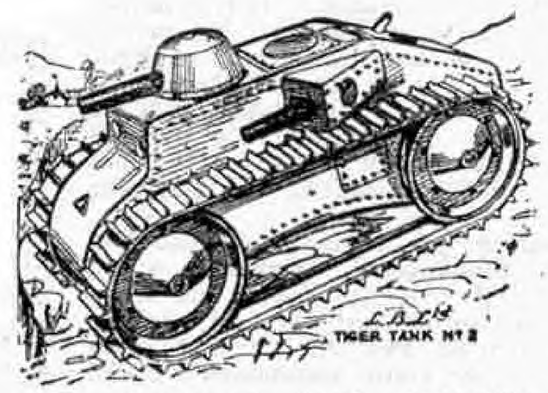
Real engineering technique is embodied in the construction of all TRI-ANG TOYS. Steel or coach built bodies to cars, pneumatic tyres, ball-bearing axles and Chromium-plated fittings. TRI-ANG clockwork toys are ideal to work with your models, they are the real thing in miniature and give endless satisfaction.



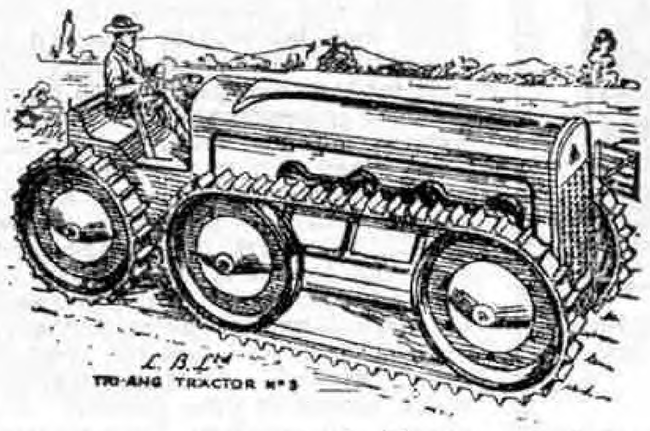
TRI-ANG TRACTOR No. 2. Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels. Length 8½". Price **3/11**



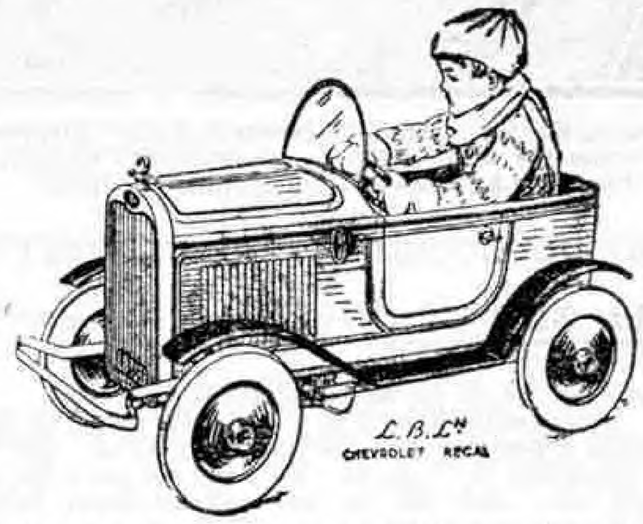
VAUXHALL CADET. A very realistic all steel car, with plated Vauxhall radiator. Adjustable windscreen, plated spring bumper. Upholstered back and dummy hood. For ages 2–4 years. Price **35/-**



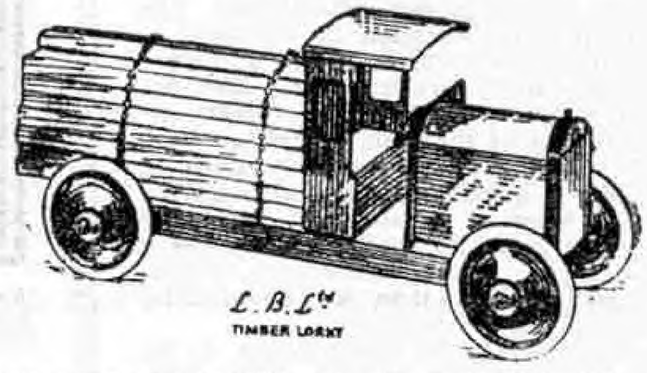
TIGER CLIMBING AND FIGHTING TANK No. 2. A powerful climber, made of steel, with wide rubber bands. Swivelling gun turret with firing device. Control lever and powerful motor. Length 10". Price **5/11**



TRI-ANG TRACTOR No. 3. Super-powered six-wheeled model. Powerful motor with two control levers—start, stop and reverse. Rubber tyres and bands on steel wheels. Nickel-plated steel body. Length 12½". Price **10/6**



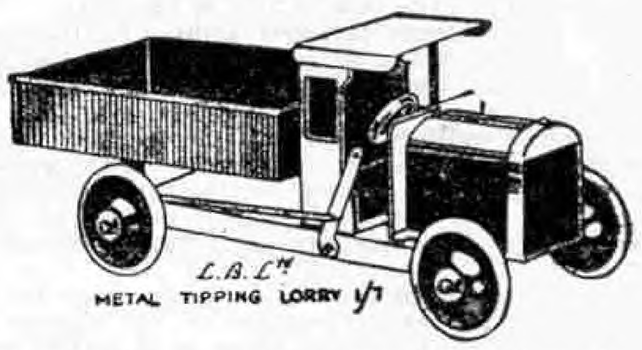
CHEVROLET REGAL. A smart pedal car with pressed stee body. Adjustable windscreen, spring bumper and correct radiator with badge. 9" balloon disc wheels with ⅝" rubber tyres. For ages 3–6 years. Price **29/6**



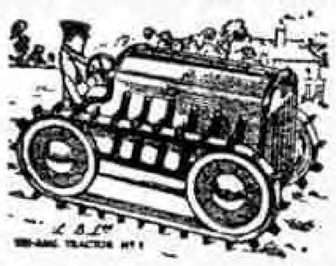
METAL TIMBER LORRY. Steel lorry loaded with planks fastened to chassis by chains. Steel disc wheels, rubber tyres.



TRI-ANG TRANSPORT SIX. Made throughout of steel. Six wheels with balloon rubber tyres. Driven by heavy flywheel geared to rear wheels Motor type steering. Complete with six cases. Length 20". Price **10/6**



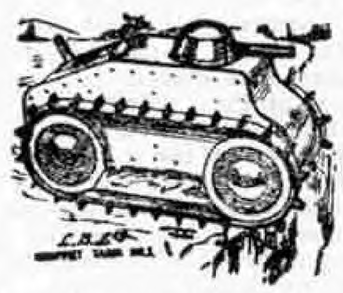
METAL TIPPING LORRY I/T. Designed on the same lines as the real thing. Body tipping is operated by lever from the driving cab. Steel disc wheels, rubber tyres. Length 17½".



TRI-ANG TRACTOR No. 1 (NIPPY). Climbs obstacles in a marvellous way. Powerful clockwork motor geared to steel wheels. Thick rubber bands. Control lever. Length 5½". Price **1/-**



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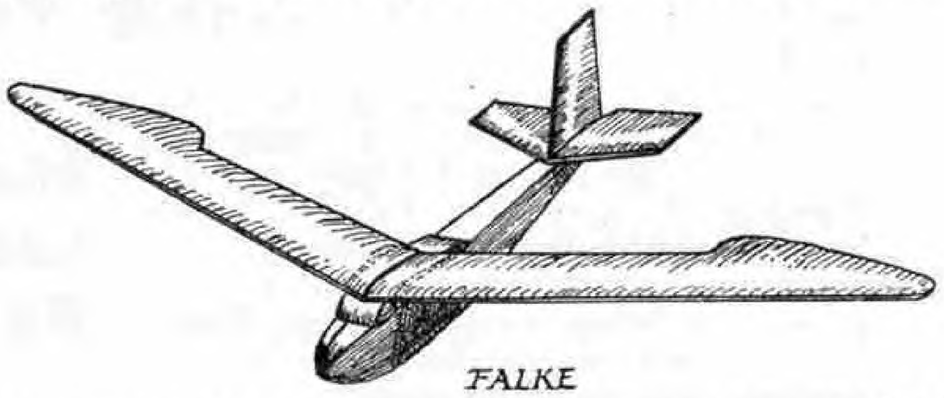
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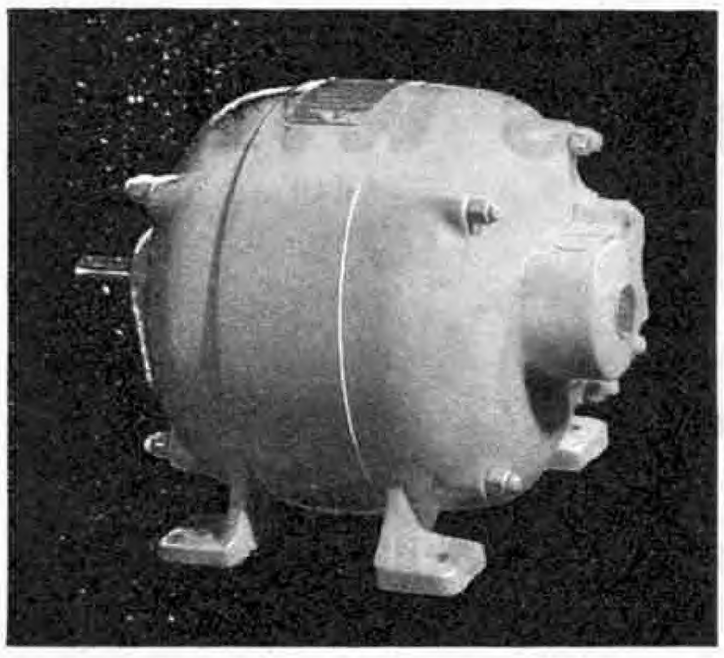


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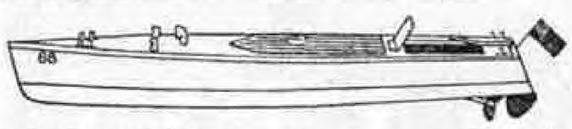
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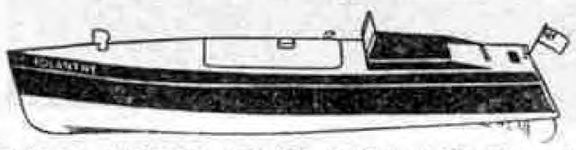
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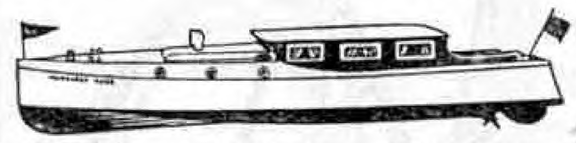
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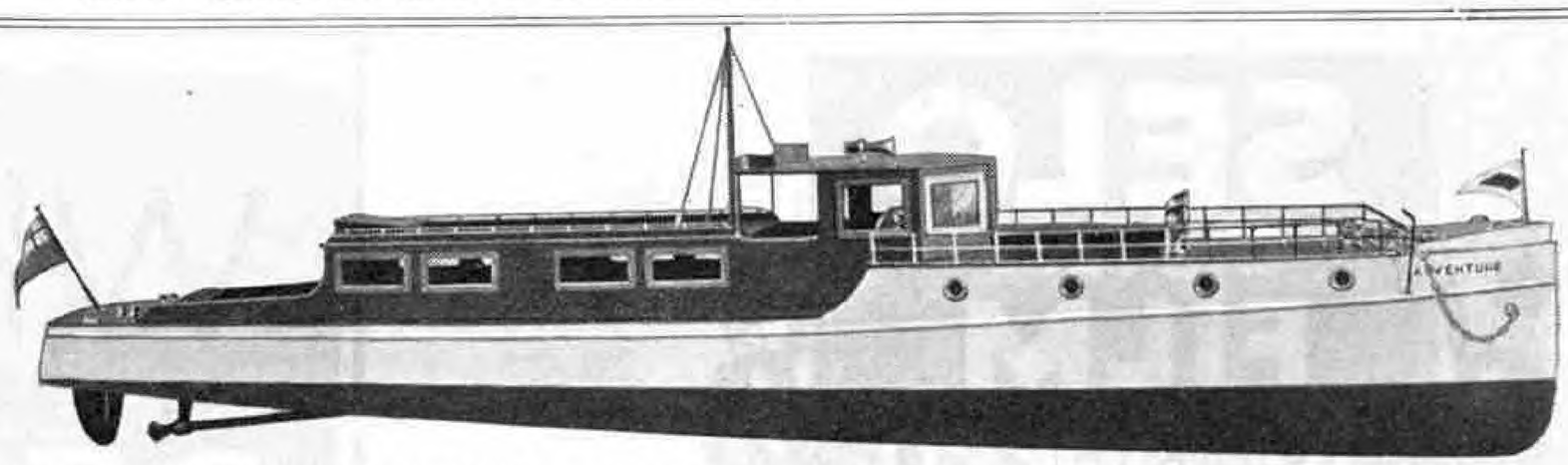
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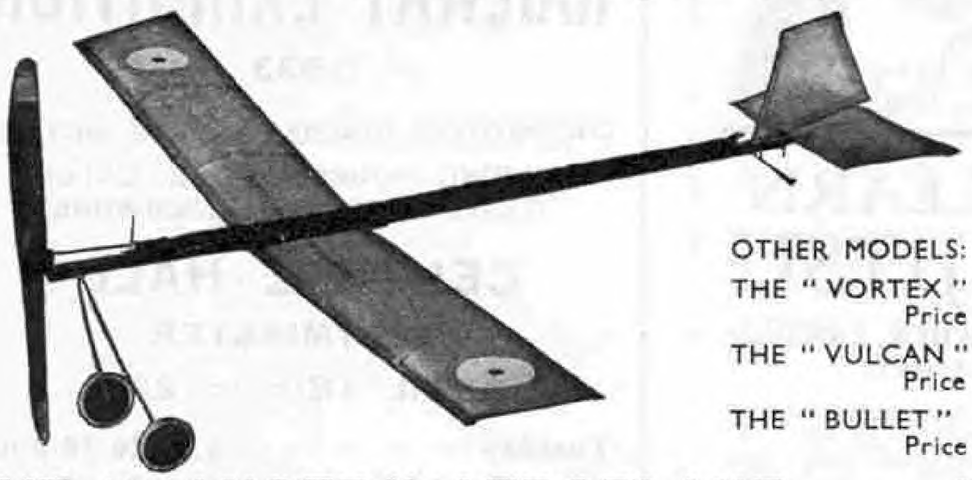
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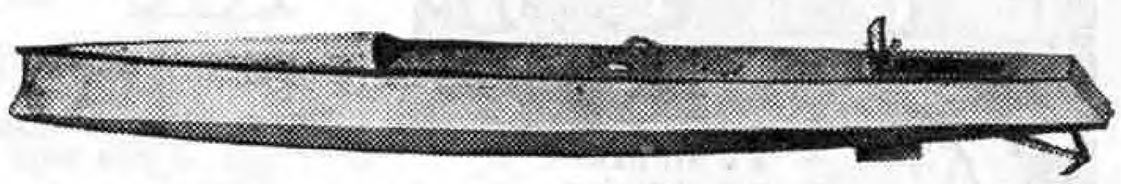
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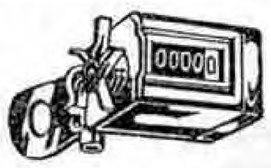
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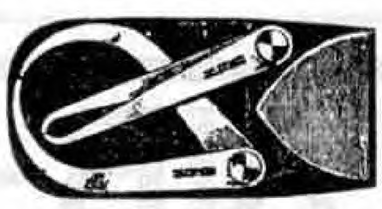
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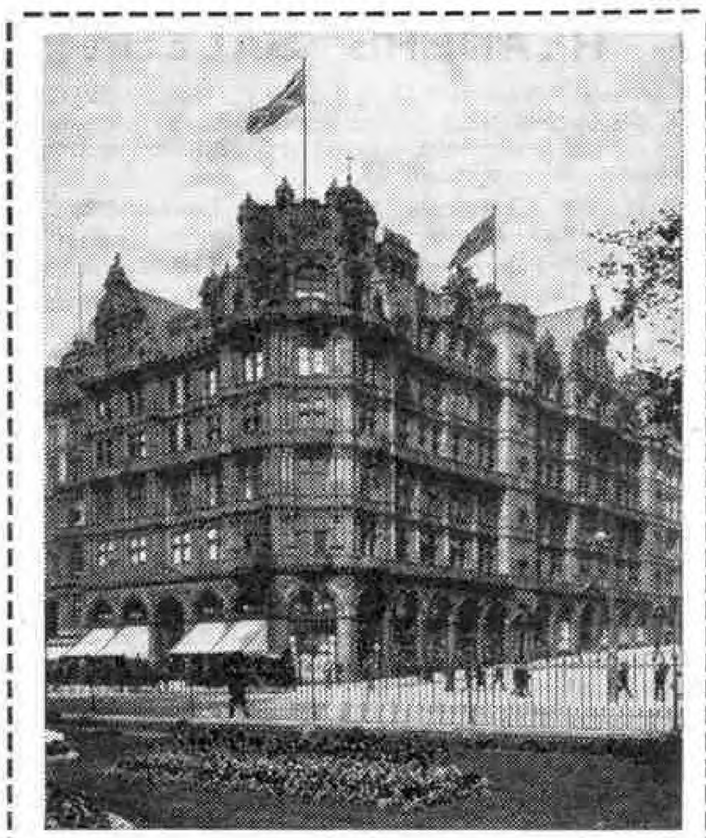
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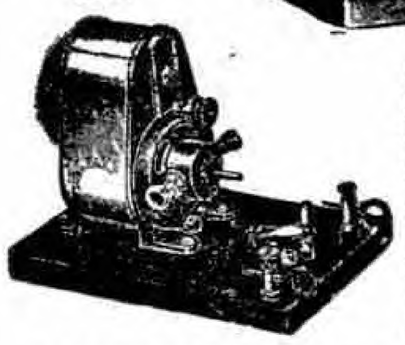
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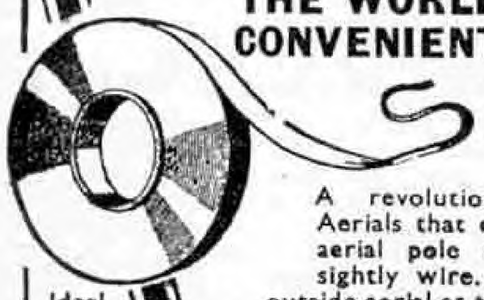


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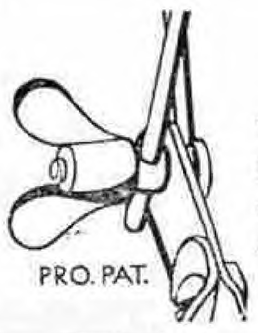
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READERS' SALES

For Sale. New B.T.H. ⅛ h.p. A.C. Motor, 220/250 volt, 50 cycles, with Woodworking Lathe complete, 70/–, or sell separately.—Newbury, 72, Gordon Road, Harborne, Birmingham.

Sale. 200 Chemicals, 10/–; 200 Containers, 2/6 dozen. Lists.—Lower, Rawcliffe, Goole.

Wanted. February, March, June and December, 1931, and January, 1932, "M.M.'s." State condition and price, including postage, to Box No. 401.

Wanted. An old Meccano Transformer, suitable to drive an old 4-volt Meccano Electric Motor off an alternating current of 230 volts.—Hunt, Cheniston, Farnham, Surrey.

Sale. Bowman Steam Engine, £1. Cost 37/6. Large Model Farm, 10/–. Cost 35/–. "M.M.'s," Jan. 1931-April 1932, 2/6 or nearest offers, all in good condition.—Fortt, 5, Pembridge Crescent, W.11.

Magic Lantern. Large 6 guinea model. Electric. Perfect Pictures, 50/–.—Lister, 25, Spencer Road, Croydon.

1,000 different Stamps in Album, 6/6.—N. Loseby, 39, Carolgate, Retford, Notts.

Silkworm Eggs, 9d. per 100, post free.—Merrick, Poplar House, Stanwell, Staines.

"M.M.'s," 1928, 1929, 1930, 2/6 year or 6/– lot. "Model Railway News," 1929 to 1932, 2/– year or 7/– lot. "O" Gauge Lowke Duke, excellent order, new spring, 12/6. Ditto, black, 10/–. Lowke "O" Tinplate Rails, 2/– dozen. 2,000 Cigarette Cards, 100 odd, 6d., 3 sets 50, 4d. each. Ensign Box Camera, 4½" × 2½", new, 22/6, accept 16/–. Full size Spalding Cricket Bat, little used, new 25/–, accept 17/6.—Rose, Brackenhurst, Hindhead, Surrey.

Sale. Miniature Railway. 50 Rails, 2 Locos, 4 Points, Crossing, and other accessories. 10/– or nearest.—Rawlings, 162, Burnt Ash Hill, S.E.12.

Collection 440 Stamps in Album, 10/6. Also "Scouts," 1932, 4/– post paid.—Soutar, Junr., 15, East Abbey Street, Arbroath.

Wanted. To exchange from all parts, 'Bus, Tram, Railway Tickets. Write—A. J. C. G., 38, Park Road, Chiswick, London, W.4.

Sale. Boat Engine, Boat Hull, Sheath Knife, Cinematograph, Frog Aeroplane, Pen Torch, Spotlight Torch, Uke Banjo, Stop Watch.—Parker, 4, King Edward Road, Moseley.

What offers? Bowman Stationary Engine, 27/6; Erector Set; No. 'A' Loco, £2; Dynamo, 12/6; Bowman "Snipe" Speed Boat, 10/–; Electric Motor, 5/–; Steam Traction Engine, 12/6. All good condition.—Mackay, Courtfield House, Trowbridge.

Stamps. Portuguese Colonies (mostly before 1898) in Loose Leaf Album, 243 Stamps, used and unused, catalogued by Gibbons £39 10s. 0d. Offers wanted—or exchange for unused British Colonials to catalogue value, £30.—Box 402.

Stamp collectors! Send stamped addressed envelope for particulars of our unique non-cash exchanging system. No subscription!—Brithdir Stamp Exchange, 17, Marlpit Lane, Coulsdon, Surrey.

Complete Commercial Correspondence Course, Bennett College (Books, etc.). Owner unable take up. Transfer buyer commence beginning. Cost £6/10/–. Sell 25/–. Particulars—BM/HEXC, London, W.C.1.

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For Sale. Pathescope Cinematograph. Cost £6. Perfect condition, like new. With good Films and Resistance. 50/–. Absolute bargain.—A. Richards, The Chestnuts, Finham, Coventry.

Bowman E.101; V.P.K.; Annuals; Violin; Warneford "Demon"; Simplex Typewriter.—4, Lorne Road, Leicester.

45/– Senior Webley Air Pistol, 1932, 21/–. 25/– Rink Skates, aluminium wheels, 10/–.—Fox, 14, Goulton Road, London, E.5.

Exchange 200 used diff. Stamps for 1 Valve Set or Parts.—T. J. Logan, St. Joseph's Road, Mallow.

Bowman Steam Loco, Tender and Rails, 22/6. Perfect. Cost 45/–. Clockwork Motor Boat, as new, 17/6. Cost 37/6.—Hill, 65, Tankerville Road, Streatham, S.W.16.

Sale. "Meccano Magazines," Sept. 1928-Sept. 1931. Excellent condition (except few covers), July-Dec. 1925, poor condition. Large Spring Binder. Offers.—Thomas, Nore Marsh, Wootton Bassett, Wilts.

Sale. Tenor Banjo and Case, 55/–; Magic Lantern and Slides, 10/–; Three Volumes Modern Motors, 15/–; 10 Automobile Electric Ties, 6/–; eight issues Cars and Motor Cycles, 6/–; four Igranic Coils, 3/–; Wonder Book of Ships, 4/–; Ditto Aircraft, 4/–.—R. Laycock, 52, Huddersfield Road, Barnsley.

Pathescope Projector with Resistance, £3/10/– (cost £7/5/–); also Super-attachment, Motor, Rewind, all brand new condition. Few brand new 30 ft. Films (guarantee band intact), 1/– each. Stamp list.—BM/VAJO, London, W.C.1.

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Wanted. Hire or purchase 16 m.m. Films.—Box 407.

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LIVERPOOL 13, ENGLAND.
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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/– for six months and 16/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

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Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

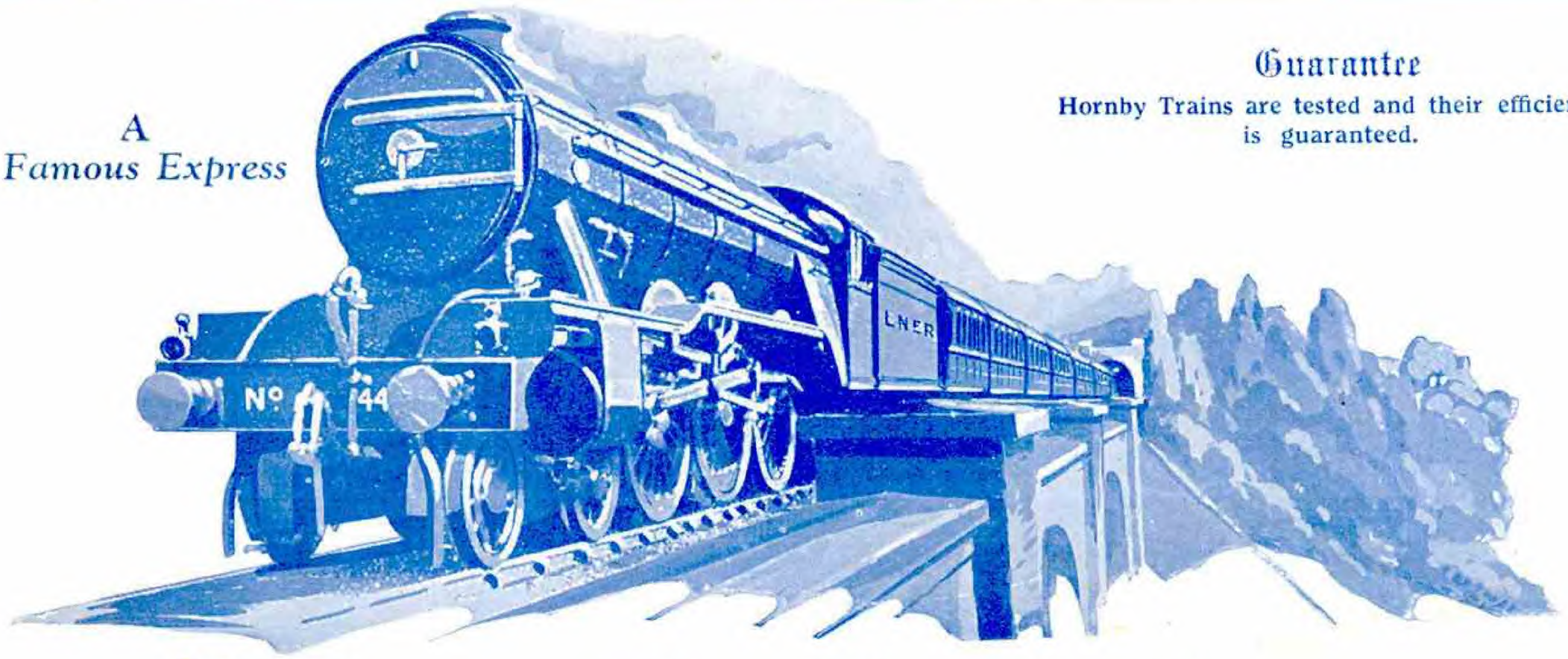
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SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
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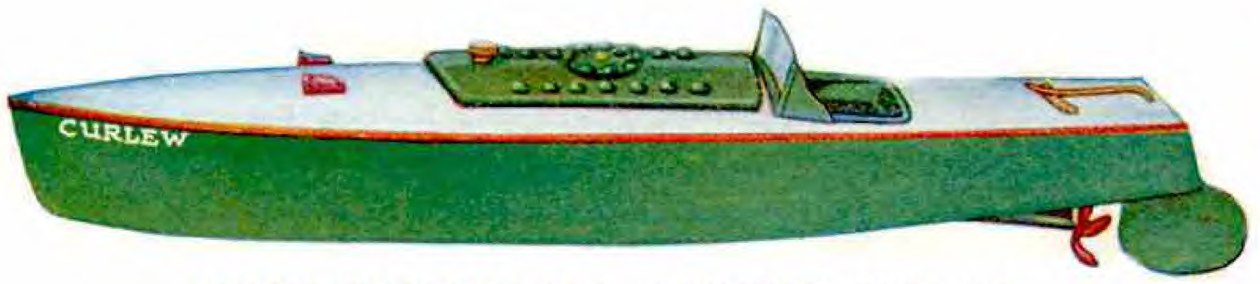
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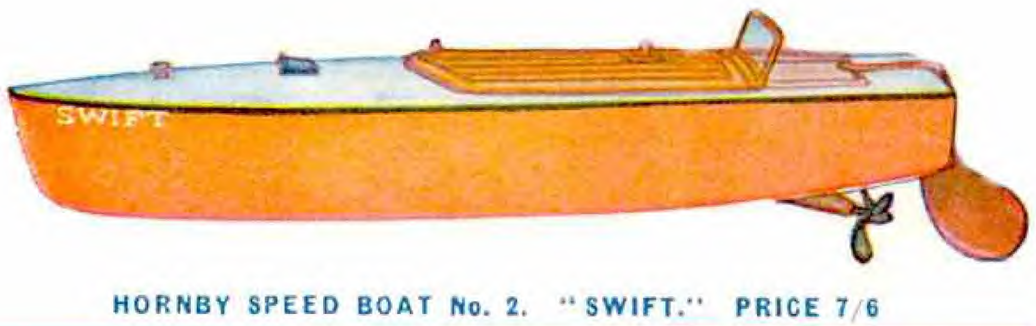
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HORNBY SPEED BOAT No. 1. "MARTIN." PRICE 5/-

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